

Rhode Island forest action plan 2020

Assessment & Strategies



Department of
Environmental Management

Division of
Forest Environment



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Acknowledgements

Catherine Sparks, Assistant Director for Natural Resources
Tee Jay Boudreau, Deputy Chief

Rhode Island Department of Environmental Management, Division of Forest Environment
235 Promenade St. Suite 394
Providence, RI 02908-5767
401.222.4700 x 2301

www.dem.ri.gov/programs/forestry/

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All maps, figures and tables are RIDEM products unless specifically noted.

Executive Summary

Rhode Island's forests blanket over more than 50% of the state. This forest cover, both private and public, offers a myriad of benefits to all Rhode Island citizens. While forested lands play an important role in providing materials for building homes and other wood products, forests also protect vital soils, preserve and improve air and water quality, and capture carbon emissions. Trees contribute to the quality of life in urban settings, play an important role in outdoor recreations and aesthetics, and are essential tools for storm water management and reducing temperatures. The relationship between forests, biological diversity, and habitat for wildlife is as equally important.

Forests provide these commodities and all their conservation roles, functions, and outputs without the care and management required by traditional infrastructure.

RIDEM's [Division of Forest Environment](#) (DFE) currently receives approximately 23% of its funding through the [Cooperative Forestry Assistance Act](#) (CFAA) through the [State and Private Forestry](#) programs (S&PF), leveraging the federal resources and partnerships in collaboration with private and public stakeholders. These programs are important components of DFE's mission and help protect public resources, support forest landowners and managers, and help to prevent the spread of wildfires:

- Cooperative Fire Program (State Fire Assistance (SFA) and Volunteer Fire Assistance (VFA))
- Cooperative Forest Health Program
- Forest Stewardship Program
- Urban and Community Forestry Program
- Forest Legacy Program

These programs contribute to the Rhode Island's Department of Environmental Management [strategic goals](#), as well as the national priorities:

1. **Conserve and Manage Working Forest Landscapes for Multiple Values and Uses**
Forest landscapes, whether under public or private management must be conserved to protect landscape functionality, habitat and environmental benefits.
2. **Protect Forests from Threats**
Rhode Island's forests face threats on multiple fronts: development leading to the loss and fragmentation, ease of spread of invasive plants and pests/diseases, loss of habitat, loss of economic and environmental benefits, and wildfire risk
3. **Enhance Public Benefits from Trees and Forests**
Support and promote the management and retention of forest lands for multiple benefits: water and air quality, carbon sinks and sequestration, temperature moderation, forest products, wildlife habitat, etc.

The Rhode Island 2020 Forest Action Plan discusses facts, trends, benefits and issues of concern, as well as priorities, goals, and strategies for the management of forest land. Five issues of concern are identified as having significant impact on the extent of forest land, and its resilience:

- **Forest Loss, Fragmentation, and Parcelization** – wildlife habitat, landscape functionality, interface and intermix, and invasive species
- **Forest Health** – invasive plants, wildlife habitat, diversity and resiliency, pests and diseases
- **Water** – stormwater, riverine/wetlands, water quality
- **Fire** – increasing intermix and expanding interface combined with increasing fuel loading
- **Climate Change** – changes to species distribution and sites, increased disturbance, exacerbation of forest health threats, phenological mismatches

For four CFAA programs, the priority service areas are within the Wildland-Urban Interface/Intermix although their target audiences may differ somewhat:

- **Stewardship** works with landowners to manage their forests, and keep their property as working lands;
- **Forest Health** focuses on introduced and invasive pests/diseases/plants, since the interface is often where they appear and are more easily spread via human transport and developed corridors;
- **Fire** targets wildfire risk planning since most fires in Rhode Island are ignited by humans in the interface and intermix;
- **Urban & Community Forestry** conveys the importance of maintaining and planning for green space to limit the negative effects of landscape use change.

The Forest Legacy Program's priority parameters are not the same as the other four programs, but the general area is quite similar, mainly the forests within the western and eastern areas of Rhode Island.

Highlights from the Rhode Island 2020 Forest Action Plan include:

- Rhode Island's forest land began to increase in the late 1800s until the mid-1900s as livelihoods shifted from farming to industry and manufacturing. A slow decrease in forest land acres has occurred since the 1970s due to permanent land-use conversions for development and infrastructure.
- 75% of Rhode Island's trees range from 40-80 years old with only 2% between 0-20 years. This disparity affects wildlife needing early successional habitat, and also indicates fewer landowners are harvesting for timber production.
- An average acre of Rhode Island forest land absorbs 1.3 metric tons of atmospheric carbon.
- Rhode Island's forest land is predominantly held in private ownership. An estimated 38,000 families and individuals own 68% of Rhode Island's forest land.
- RIDEM's Divisions of [Forest Environment](#) (DFE) and [Fish and Wildlife](#) (DFW) manage more than 40,000 acres of state-owned forests.
- DFE provides services to private landowners with a field staff of 11:
 - 1 State Lands Forester in DFE
 - 1 Stewardship Forester working with private landowners
 - 1 Forest Health Program Coordinator
 - 1 Urban and Community Forestry Program Coordinator
 - 3 staff to maintain of DFE-managed Management Area trails, roads and campgrounds
 - 4 Forest Fire staff delivering training, outreach, plans and prescribed fire, and assisting DFW with prescribed fire
- Invasive pests continue to challenge forest management, whether gypsy moth outbreaks, new arrivals like emerald ash borer in 2018, or looming pests like spotted lanternfly presently spreading aggressively through PA and recently confirmed in NY.
- Of the many benefits provided by green space and natural areas is the human health effects (air quality and urban heat islands) which is important considering that Rhode Island is 11th nationally in ADHD/ADD, and 9th in asthma conditions per capita. (Covid-19 has recently emphasized the impact of impaired lung capacity and has highlighted economic disparities in community impact.)

There are many challenges facing Rhode Island, and the Division of Forest Environment, to meet the goals set out in this Forest Action Plan; most significantly, the lack of adequate funding and sufficient staffing levels. However, with this clear and thoughtful action planning process, the Division hopes to initiate positive change and meaningful improvements to the State's forest resources, and all of the creatures it serves.

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Rhode Island 2020 State Forest Action Plan

INTRODUCTION

The Rhode Island 2020 Forest Action Plan is part of a nationwide strategy that codifies the national priorities of federal and state private forestry programs. The [Cooperative Forestry Assistance Act](#) (CFAA) was amended by the [Food, Conservation, and Energy Act of 2008](#), commonly referred to as the 2008 Farm Bill, to require that states and territories assess all forest land within their boundaries, and develop strategies to improve the health, resiliency, and productivity of their forests, starting in 2010.

These statewide forest assessments, or forest action plans (SFAP), are required for maintaining eligibility to receive funds under the authorities of the Act, through the USDA Forest Service [State and Private Forestry](#) (S&PF), and must be updated every 10 years. The SFAPs provide an analysis of forest conditions and trends, identify issues and priorities, and outline strategies to ensure healthy trees and forests into the future. The SFAP must also address the three national S&PF priorities included in the 2008 Farm Bill:

- **Conserve** and Manage Working Forest Landscapes for Multiple Values and Uses
- **Protect** Forests from Threats
- **Enhance** Public Benefits from Trees and Forests

The Rhode Island 2020 State Forest Action Plan is comprised of two distinct sections:

1. ASSESSMENT

The Assessment section provides a discussion of Rhode Island's forest-related conditions, trends, and opportunities and is aimed at ensuring that federal and state resources are being focused on high priority areas with the greatest opportunity to achieve meaningful outcomes.

- a. **Forests, Conditions & Trends** contains current information and data, discusses current forest conditions, ownership and use trends, and the benefits derived from healthy forests.
- b. **Issues, Threats & Opportunities** discusses the priority issues impacting the health and management of forests and forest land.
- c. **Priority Landscape Areas in Rhode Island** identifies the target areas for the programmatic cooperative forestry activities.
- d. **Multi-State Priorities** lists Rhode Island's regional and national engagement efforts.
- e. **Stakeholder Engagement** describes the input into the SFAP priorities and stakeholder process.

2. STRATEGIES

The Strategies section provides short- and long-term plans for investing state, federal, and other resources to where it can most effectively stimulate or leverage desired action and engage multiple partners. The strategies are built on the understanding that forests are long-term investments that need near term actions to contribute to progress over decades with which a comprehensive and coordinated approach will improve effective progress.

- a. Goals and Objectives, addressing the three national priorities, have been developed for each of the cooperative programs of Fire, Forest Health, Stewardship, and Urban Forestry. Each program has identified strategies within its capacity and its priority areas.
 - i. A summary matrix is provided in this section.
 - ii. A matrix of the correlation of the Goals and Objectives with the Department of Environmental Management's *Strategic Plan 2019-2022* is in [Appendix E](#).
- b. The Forest Legacy Program's *Assessment of Need* is attached as [Appendix F](#).

Taken together, Rhode Island will use the State Forest Resource Assessments and Strategies to target program delivery and develop competitive proposals for addressing priority landscape areas and issues.

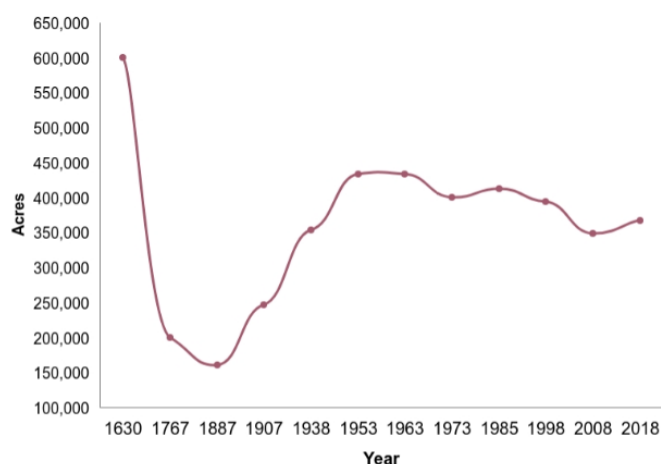
Rhode Island

2020 State Forest Action Plan: Assessment

FOREST CONDITIONS & TRENDS

Forest management planning is not a static process; it is a dynamic one, responding to changes wrought by:

- events that transcend local forest systems, like hurricanes, droughts, and other natural disasters;
- pests or diseases, such as gypsy moth or emerald ash borer, that impact trees directly, threatening the forest health or productivity; and
- invasive plants, changes in weather and precipitation patterns, or wildlife browse, that impact the growing conditions and success of tree establishment and growth.

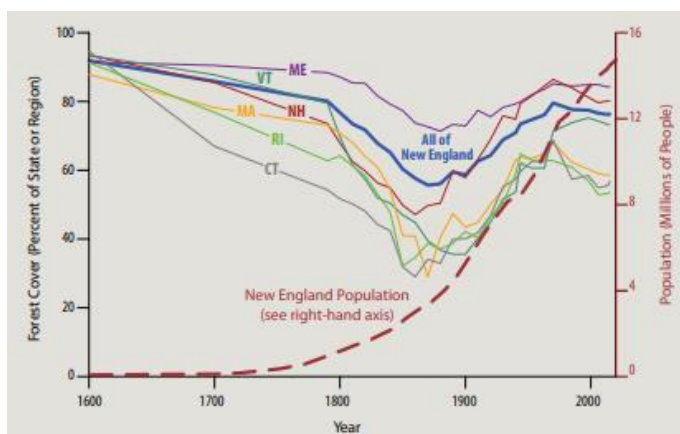


Approximate Forest Area in Rhode Island 1630-2018.

Sources: [RI Wildlife Action Plan](#); [Forests of Rhode Island, 2018](#)

Some of these events are abrupt, showing consequences in hours or days, while others progress for years with increasing impact and management implications.

Historically, Rhode Island was mostly forested by deciduous trees, primarily oaks, hickories, and red maple, with ~15% being coniferous forests comprised of white pine, pitch pine, and hemlock. This forest acreage has waxed and waned over the history of human residence. Native American forest activities on and within the forests impacted land cover significantly less than natural events like wildfire. By comparison, colonization in the early 1600s resulted in nearly 100% of forest land being cleared over the next ~125 years, reaching its lowest point in the late 1800s.



New England Forest Cover and Human Population.

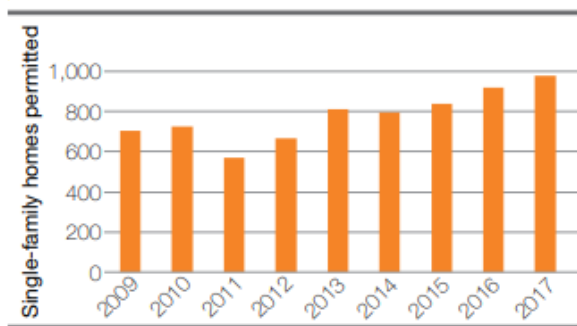
Source: [Wildlands and Woodlands, Farmlands and Communities: Broadening the Vision for New England](#).

Not solely confined to Rhode Island, this pattern of land clearing occurred throughout New England: a decrease in forest land associated with population growth, followed by a rebound in forest land as farmland was abandoned, populations migrated, and social shifts like wars, the Great Depression, and industrialization occurred. By the mid-20th century, the reforestation of [67%](#) of Rhode Island had occurred, as small-scale farming as a livelihood did not recover in the post-war, post-industrial years.

However, forest land acreage began to shrink again in the 1970s, which the [Department of Administration Division of Statewide Planning](#) attributes to changing development patterns:

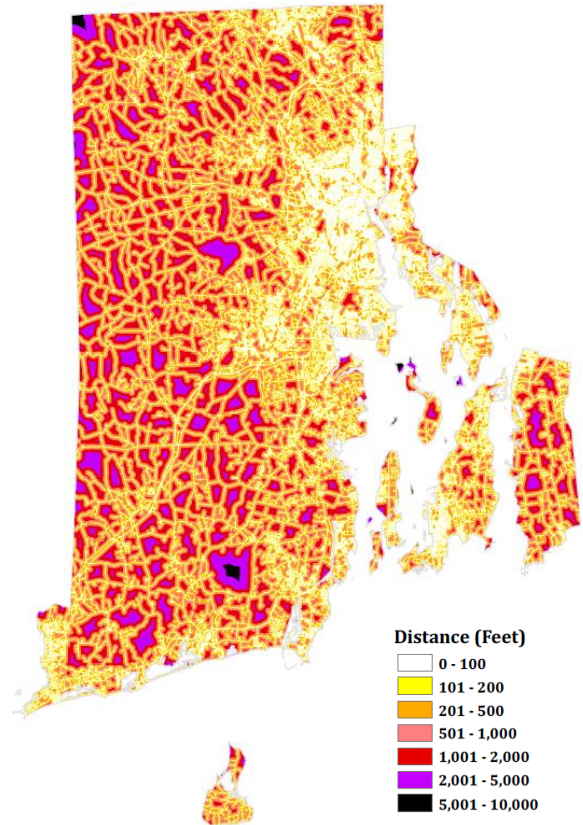
- smaller households but larger houses, consuming more land per house;
- population movement from urban to rural areas, expanding the impacts of development into rural and forested areas; and
- commercial land use, which has almost doubled, extending into less developed parts of the state and concentrated along heavily traveled roadways.

Historical information and aerial photography shows that the rate of permanent land conversion in Rhode Island has been [increasing since the 1960s](#) with more development of residential, commercial, and industrial land between 1970 and 1995 than in the previous 325 years. Even as recovery from the Great Recession has been slow, single home construction has increased by [9% yearly since 2011](#). Rhode Island already has [6,027 miles of permanent roads](#), as communities expand and increase, the supporting gray infrastructure must also increase to support the population (schools, roads, businesses, etc.), which comes at an environmental cost.



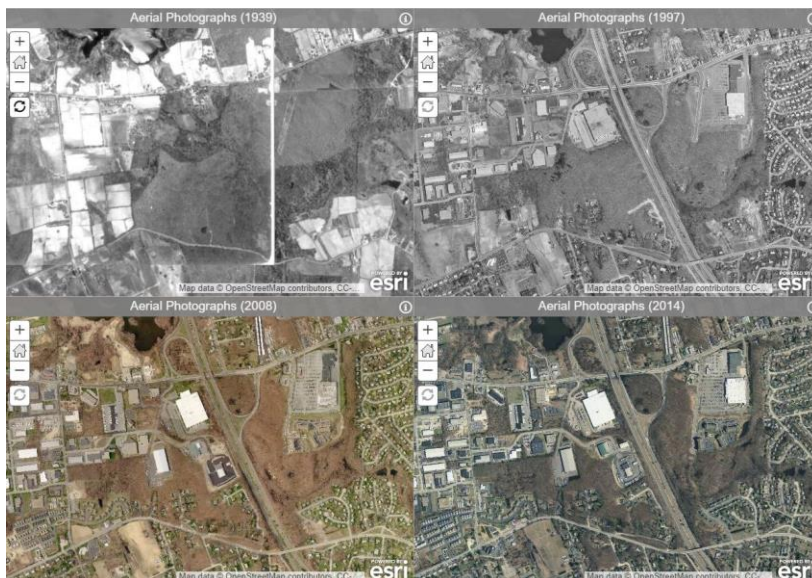
On average, single-family home construction in Rhode Island has increased since 2012.

Source: [HUD PD&R Housing Market Profiles: RI](#)



Distance to Nearest Road.

Source: Peter August, Department of Natural Resources Science, University of Rhode Island



The photo series on the left depicting land use change along Interstate I295 at Plainfield Pike (Route 14) (years: 1939, 1997, 2008, 2014), clearly shows the increase in gray infrastructure needed to support increasing populations and residents, services and transportation.

Rhode Island Forests

The *Rhode Island 2020 Forest Action Plan: Assessment* utilizes historical [USDA Forest Service](#) (USFS) [Forest Inventory Analysis](#) (FIA) data to maintain a consistent description and to directly compare historical acreage estimates to the present. The Rhode Island [Department of Environmental Management](#) is moving towards land-use estimates, assumptions, and definitions based on the DOA/DEM/RIGIS 2011 Landuse/Landcover (LULC) data and DEM land records, as used in the 2015 Division of Fish & Wildlife's [Wildlife Action Plan](#) (RI WAP), for future statewide forest management estimations, as new mapping methods and technology become available to the Department. [Appendix A](#) describes these methodology differences.

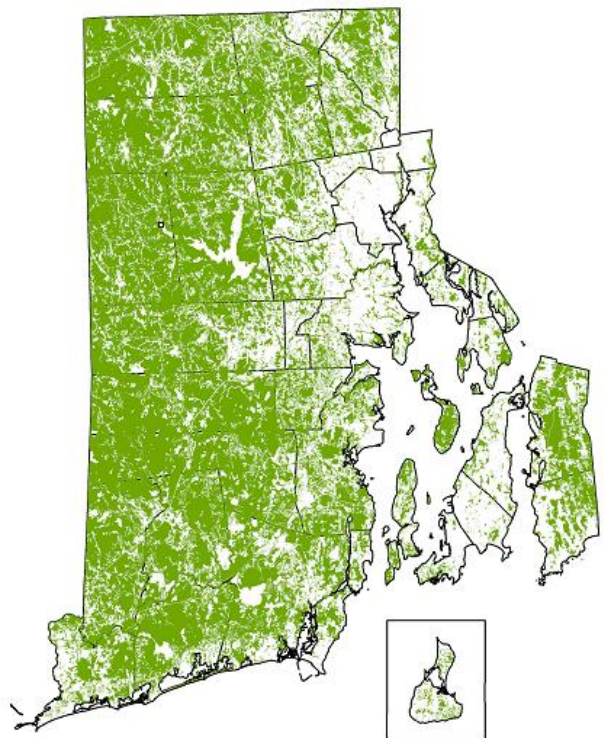
The first USFS FIA survey in Rhode Island was completed in the 1950s. Since 2003, annual FIA sampling updates and reports have included data on the status and trends in forest area and location, estimation of species, tree size, and health of trees; total tree growth, mortality, and removals by harvest; wood production and utilization rates by various products; and forest land ownership.

The status of Rhode Island's forests is based on FIA estimates, where 1/7th of the permanent plots are assessed each year. This [annualized forest census](#), carried out nationally, projects how forests are likely to appear 10 to 50 years from now and enables evaluation of the sustainability of current forest management practices.

According to the most recent FIA report, [Forests of Rhode Island, 2018](#), Rhode Island contains an estimated 366,958 acres of forest land – 53% of the total land area of the state. Rhode Island's forests are considered second growth and approximately 96% is classified as timberland, forest land that exceeds the minimum level of productivity and is available to harvest.

Since FIA collects data on a rolling average the data may be affected by denial of access to properties, the spreading out of mortality and recovery updates, or changes to data collection protocols as technology and applications advance. Rhode Island, a small state, is subject to a higher sampling error (3.5 - 4.0% typically for forest land estimates) than larger states. These factors must be kept in mind when viewing the change in the acres of forest land in the state. The estimated 356,000 acres of forest land discussed in the [2010 State Forest Action Plan](#) is now estimated to be ~367,000 acres in the [Forests of Rhode Island, 2018](#) report.

While the 2018 FIA forest land estimate of 367,000 acres shows an increase from 356,000 acres in 2007, this may be partly accounted for by the explanation of changes in FIA protocols. This estimated increase in acres should not be assumed to indicate that forest land and habitat have increased (or are increasing) and are not at risk.



Extent of Forests in Rhode Island.

FOREST TYPES & SPECIES COMPOSITION

Undisturbed forest composition tends to change slowly, with forest succession as the main agent of change, barring large-scale tree loss events, such as wildfires or storms. Rhode Island forests have not been

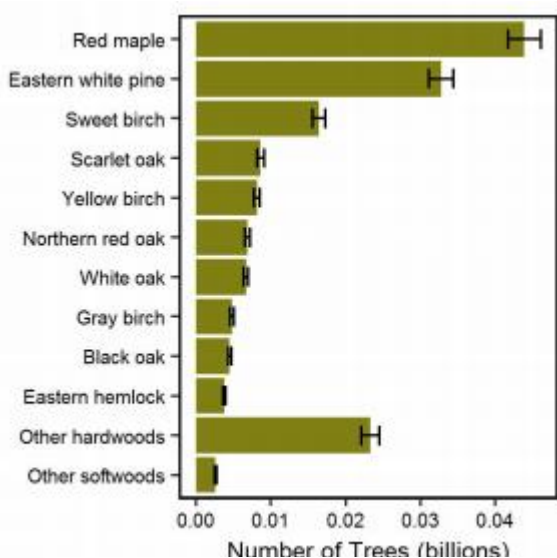
substantially affected by such catastrophic events since the 1960s. However, forest composition has been affected by widespread pests and diseases, including chestnut blight (*Cryphonectria parasitica*) and Dutch elm disease (*Ophiostoma ulmi*). More recently, the gypsy moth infestations from 1980-86 impacted [~3/4s of Rhode Island's canopy](#), contributing to a subsequent documented increase in the number of red maples reported in USFS FIA data. The recent gypsy moth outbreaks (2015-2018) and the occurrence of emerald ash borer (confirmed 2018) is anticipated to affect forest species composition, resulting in a decrease in the overall presence of oak species and of all ash species being extirpated. The impact on future forest composition is expected to increase in the proportion of pioneer species such as red maple, black cherry and black birch in the future forests of Rhode Island.

The significance of the most recent mortality events on forest species composition may not be completely apparent until a full 7-year panel of FIA data has been collected, post gypsy moth outbreak. As EAB spreads throughout the state and mortality is documented, the full impact of the loss of multiple species of ash in natural and urban areas will take time to be fully realized and assessed.

These mortality events will also impact sawtimber volume and numbers, with additional impact from the expected heavy deer browse on future forests. USFS FIA surveys have noted a lack of understory seedlings in the permanent sample plots revisited, which suggests that there may be an effect on the establishment of tree species regeneration.

Rhode Island's forests contain a wide variety of tree species with over 46 species sampled in 2017. Red maple is the dominant tree species by number, comprising 27% of the tree stems in the state. Other common species include eastern white pine, black birch, scarlet oak, and yellow birch, accounting for 67% of the trees by number. The most commercially valuable species are Eastern white pine and red oak, making up 56% of the wood volume.

With respect to forest type, oak-hickory forest (dominated by red, black, scarlet, and white oak) comprises 61% of the forest, decreasing from earlier FIA data (66 % in 1972). Red pine/white pine forests have also decreased (from 12 % to 9 %) in that same timeframe. This decrease coincides with increased harvesting activity shown in DFE *Intent to Cut* records as red pine plantations were salvaged, due to the effect of the red pine scale. By 2010, the "other softwoods" category had almost disappeared from harvesting reports. Other forest types, like pitch pine and Atlantic white cedar, make up a small percentage (~3+%) of Rhode Island's forest but have high importance due to their value as wildlife habitat.



Number of Trees ≥ 1-inch DBH by Species.

Source: [Forests of Rhode Island, 2017](#).

Forest-type group	All size classes of forestland (% of land cover?)
White / red / jack pine	8.8%
pitch pine	3.2%
Oak / pine	5.3%
Oak / hickory	61.0%
Oak / gum / cypress	6.3%
Elm / ash / cottonwood	4.7%
Maple / beech / birch	6.4%
Aspen / birch	1.9%
Other hardwoods	1.5%
<u>Nonstocked*</u>	0.9%
Total	100.0%

Stocked with All Live Trees.

Source: [Forests of Rhode Island, 2017](#).

USFS FIA [FOREST TYPE](#) DESCRIPTIONS

White-red-jack pine: Forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, aspen, birch, and maple.

Pitch pine: not an FIA forest-type group, but pitch pine falls under the loblolly/shortleaf pine group and it would be misleading to use that name when neither of those species are present in Rhode Island.

Oak-pine: Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking, but in which pine or eastern redcedar comprises 25-50 percent of the stocking. Common associates include gum, hickory, and yellow-poplar.

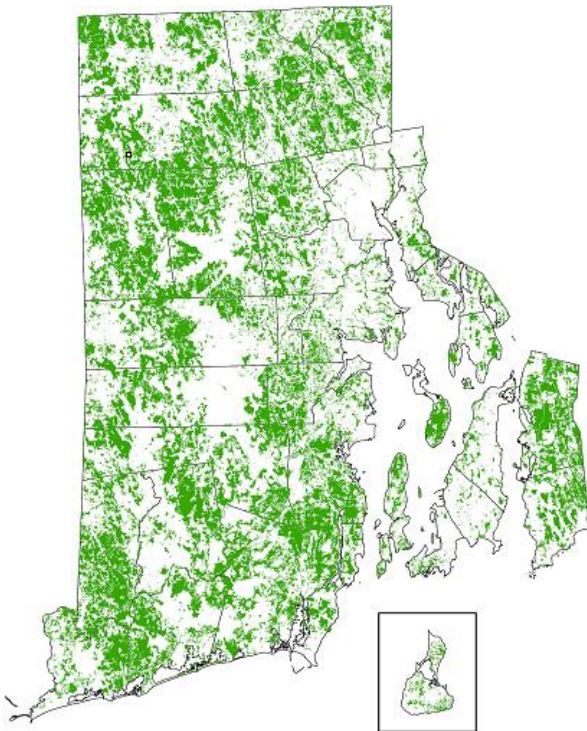
Oak-hickory: Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-50 percent, in which case the stand is classified as oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

Elm-ash-cottonwood: Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, beech, and maple.

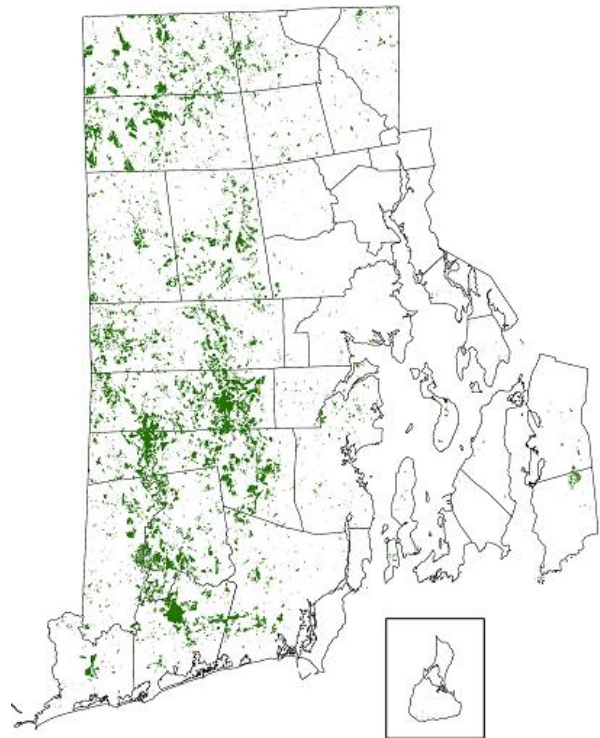
Oak-gum-cypress: Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-50 percent, in which case the stand is classified as oak-pine. Common associates include cottonwood, willow, ash, elm, hackberry, and maple.

Maple-beech-birch: Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, elm, basswood, and white pine.

Aspen-birch: Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprise a plurality of the stocking. Common associates include maple and balsam fir.



Distribution of Deciduous Forests.

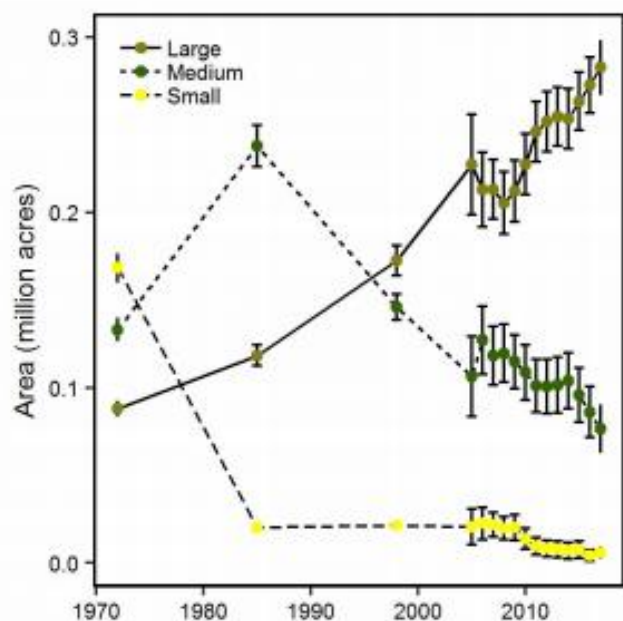


Distribution of Coniferous Forests.

FOREST AGE/MATURITY

The [Forest Futures Dashboard](#), using 2007 FIA data, estimates that northern forests, as a whole, lacks age-class diversity. In Rhode Island over 75% of its trees are 40-80 years old. Only 1% of RI's trees are estimated to be older than 100 years which, given the potential longevity of most tree species, is still comparatively young. Of greater concern is the extremely low 2% of trees in the 0 to 20-year range – the future forest. In fact, Rhode Island has the lowest proportion of old and young trees of any of the 20 northern states included in the assessment.

Age of Timberland	
More than 100 yrs	1 %
81-100 years old	11 % █
61-80 years old	54 % ██████████
41-60 years old	23 % ████████
21-40 years old	9 % ███
1-20 years old	2 % █



Area of Timberland by Stand-Size Class.

Source: [Forests of Rhode Island, 2017](#)

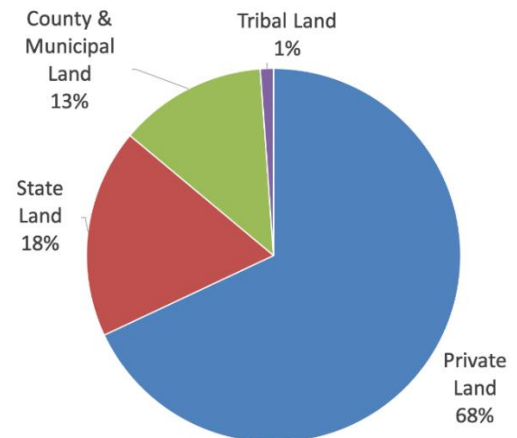
Ten years later, the [Forests of Rhode Island, 2017](#) report indicates that the trend continues with 77% of the timberland large or sawtimber size (over 9 inches in diameter at breast height for softwoods and 11 inches for hardwoods), 21% medium or pole size (5 to 10.9 inches) and 2% small, or young, regenerating trees (less than 0.5 inches).

Rhode Island has had relatively few stand replacing events over the past few decades contributing to the overall maturing of Rhode Island's forests; a large percentage of the forest land is in the largest stand size class and steadily increasing. This has significant implications for forest resilience (i.e., the ability of the forests to withstand severe weather events or insect infestations), wildlife habitat/diversity, and other ecological functions.

Forest Ownership

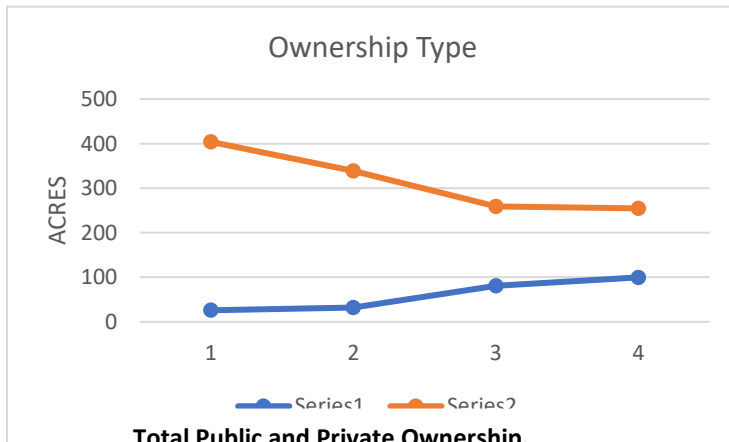
Rhode Island's forests are owned and managed by a combination of federal agencies and programs, state agencies and programs, national and local land trusts and other conservation organizations, and private landowners.

A [USDA Forest Service Report from 1957](#) estimated that 94% of Rhode Island's forests were privately owned. [By the late 1980s](#) private ownership had decreased to 85% and continues to decrease. The [2020 State and Private Forestry Fact Sheet](#) for Rhode Island states that approximately 68% of forest land is privately owned and managed by an estimated 38,000 landowners, including conservation organizations and nonprofits.



Forest Ownership in Rhode Island.

Sources: [Forests of Rhode Island, 2017](#) and [USFS FIA Estimate Tables](#)



Total Public and Private Ownership.

Source: [Forests of Southern New England, 2012](#)

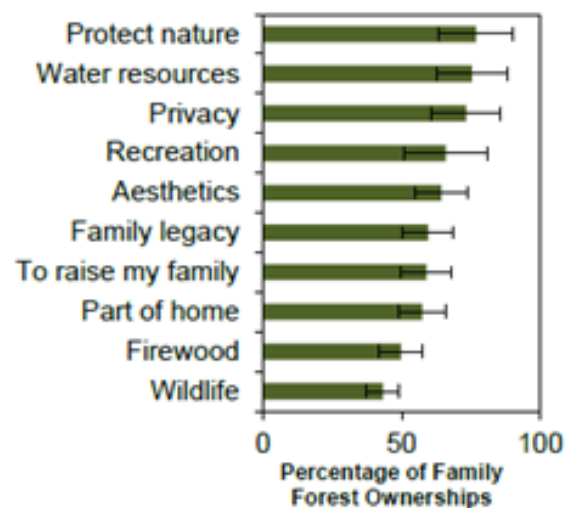
This decrease in privately owned forest can be attributed to both conservation efforts by public agencies, and the pattern of land ownership shifting from subdivisions of large ownerships (with an average parcel size of 26 acres in 1973 to 17 acres in 2012). The 2012 [Forests of Southern New England](#) report estimates that evaluating only privately-owned parcels greater than 10 acres in Rhode Island, parcel size is about 27 acres, lower than in the past, and lower than the average size in southern New England of 34 acres.

The 2003 Statewide Planning Analysis of land use found 15 communities in Rhode Island with less than 25% developed land area, classifying them as rural. The analysis included a [survey of landowners](#) owning more than 10 acres:

- 37% owned less than 20 acres
- 22% owned less than 30 acres.

The 2003 survey found most Rhode Island forest owners live on their land and 90% of respondents agreed that a place of residence was the most important reason for owning forest land. Other popular reasons for owning forest included investment (42%), recreational use (41%), forest products (33%), and hunting/fishing (19%).

Ten years later, a comparison to the USFS [2013 National Woodland Owner Survey](#) shows that the reasons for owning and retaining forest land has not changed, with owners still primarily concerned with beauty, nature, legacy, privacy, and investment:



Reasons for Owning Forest Land, Family Forest Ownerships 10+ Acres, 2011-2013.

Source: [Forests of Rhode Island, 2013](#)

- Most respondents lived on their land (64%) and owned it for the lifestyle it provided (enjoying beauty and scenery)
- Harvesting wood products were not as important as the other amenities (36%)
- Using it for timber products was even less important (18%)
- Other reasons for owning were to protect water (73%), protect nature and biologic diversity (73%), and protect wildlife (55%)

[Additional research](#) by the American Forest Foundation suggests that landowners who are actively involved with their land are less likely to engage in activities that often have negative conservation impacts (such as selling, subdividing, or developing land).

FOREST OWNERSHIP & PARTNERSHIPS: FEDERAL, STATE, LOCAL AND OTHER ORGANIZATIONS

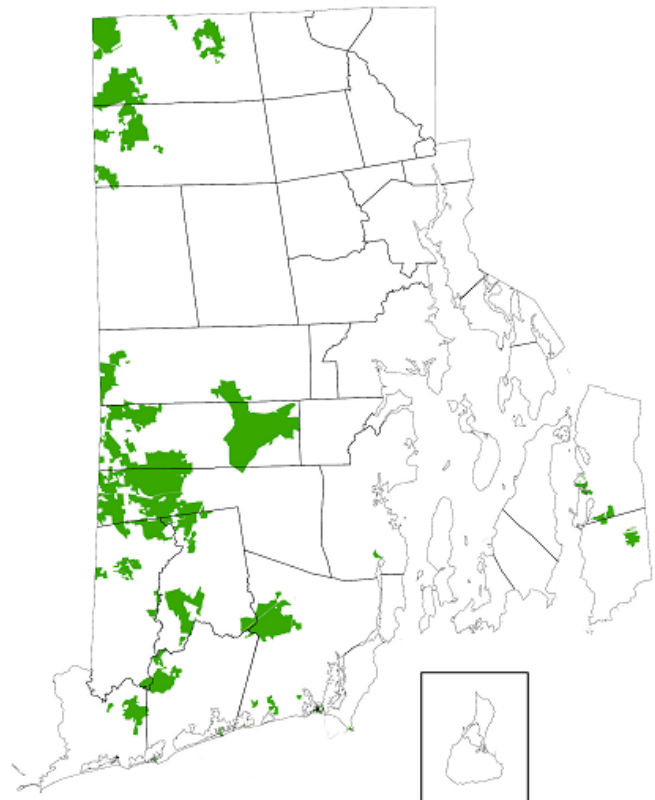
Federal Agencies

The [USDA Forest Service](#) (USFS) and the [USDA Natural Resources Conservation Service](#) (NRCS) are the main federal agencies responsible for providing or administering funding, research, educational and technical assistance to the state and private citizens for the management of rural and urban forests, as authorized by the Farm Bill ([Agricultural Act of 2014 \(P.L. 113-79\)](#)). The Rhode Island [Department of Environmental Management](#) (RIDEM) delivers programs related to Forest Health, Fire, Forest Stewardship, Urban Forestry, and Forest Legacy supported by USFS grant funding. The USFS Northern Research Station is responsible for the FIA program in Rhode Island. NRCS works directly with private landowners providing funding and technical support.

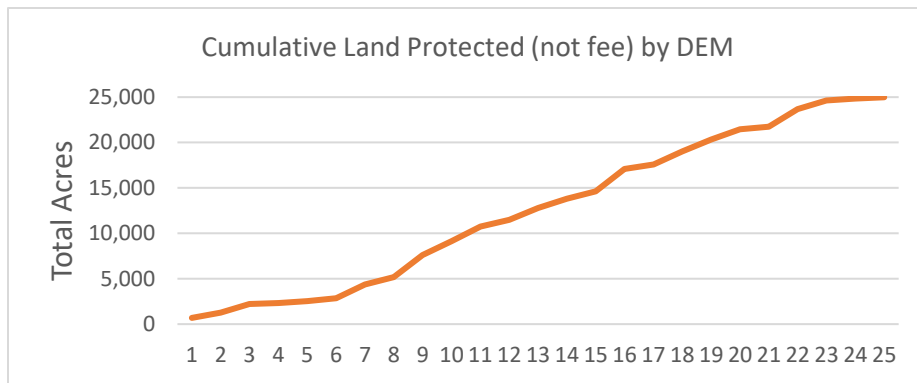
State Agencies

RIDEM permanently protects 73,324 acres of forest land, owning 47,384 acres of forest land in fee, and holding additional interests on 25,940 acres through conservation easements, deeds to development rights, and recreation easements. This protection includes 22 parcels, encompassing 3,583 acres, protected through conservation easement or fee purchase by the Forest Legacy Program, overseen by the Division of Planning and Development. The Division of Forest Environment (DFE) is the main agency charged with overseeing the state's forest resources, managing 40,000 acres of state-owned forests. Through DFE, federal funds and state match are used to administer the [Farm, Forest and Open Space](#) (FFOS) Program to meet national priorities for the management of private forest land; for fire protection-related planning and activities; for forest health monitoring and response to insects and disease; and for delivery of an Urban & Community Forestry Program.

The graph below shows trends in land acquisition by DEM although most of the acquired land DEM is farmland or open space with recreational potential.



RI DEM Management Areas.



Total Acres Owned by DEM from 1993 to 2018.

Municipal and Local Governments

Based on [2010 census](#) data, Rhode Island is ranked the second-most densely populated state after New Jersey. Forest land owned by local government is important when considering the full picture of forest cover in Rhode Island as it includes [urban forests](#) as well. In 2006, the Statewide Planning Program developed the [Urban Services Boundary](#) as a GIS overlay, defined as the general extent of the area where public services supporting urban development presently exist, or are likely to be provided, through 2025. Comprising 13% of land ownership in Rhode Island, natural areas owned by local governments may be held for expansion or buffering of existing natural resources, or set aside for future parks, cemeteries, hospital grounds, schoolyards. Urban forests are not defined as an ecological community, overlooked as a natural resource, but are increasingly identified as contributing to the well-being and environmental goals of residents.

Land Conservation Organizations and Other Public Institutions

Land conservation organizations and agencies – including [The Nature Conservancy](#) (TNC), [Audubon Society of RI](#) (ASRI), municipal and private land trusts, municipal governments, private homeowner associations, [Providence Water](#), and the [University of Rhode Island W. Alton Jones Campus](#) – hold varying degrees of protection on 51,616 acres. Most of this land is permanently protected in fee or through easements, but some land held by land conservation organizations or other institutions has no legal mechanism in place for permanent protection, even though the land is not likely to be developed.

Rhode Island has over 45 active land trusts (community-based organizations which protect farms, forest land and open spaces by purchasing easements and/or acquiring land). Supported by the Rhode Island Land Trust Council, a statewide coalition, land trusts monitor their properties and easements to ensure that the lands are being properly conserved and managed.

Non-Profit Organizations and Other Assistance

Private landowners work with several organizations and programs that provide financial and technical assistance to help with the management and stewardship of their forests including:

[Rhode Island Forest Conservators Organization](#) (RIFCO) – RIFCO is dedicated to the protection and wise use of Rhode Island’s woodland resources, promoting stewardship of Rhode Island’s wooded lands and watersheds and better awareness of the role of a healthy forest and provides information and education to the public on issues affecting forest land. RIFCO members include natural resource professionals, land trust and forest product industry representatives, and citizens concerned with forest conservation issues.

[Rhode Island Association of Conservation Districts](#) (RIACD) – RIACD supports the three conservation districts in the state ([Northern](#), [Southern](#) and [Eastern](#)).

The [Rhode Island Tree Council](#) (RITC) – RITC cooperates closely with USFS and DFE, supporting the Urban and Community Forestry program through partnership and collaboration. RITC also works with businesses and municipalities to implement tree planting and stewardship programs across the state.

The [Rhode Island Woodland Partnership](#) (RIWP) – RIWP is becoming an integral part of DFE’s delivery and engagement. The goal of the Partnership is to collaborate, sharing support and expertise to advance the stewardship and long-term protection of Rhode Island’s woodlands for the benefit of the local economy, ecological values, and community enjoyment and health. RIWP is comprised of foresters, landowners, non-profit organizations, small businesses, conservationists, and professionals who represent public agencies. The nature of the RIWP membership, and the small size of the state, allows RIWP to act as both the Stewardship Advisory Council and the [Forest Ecosystem Monitoring Cooperative](#)’s (FEMC) State Partnership Committee. RIWP is also actively involved with the [Regional Conservation Partnership](#) network.

[American Tree Farm System](#) – The ATF Program certifies private landowners actively managing their forests and promoting sustainable stewardship on their lands. In Rhode Island, this is currently a recognition-only program, without certification. The [RI Tree Farm Database](#) currently lists 250 Tree Farms in Rhode Island with a total of 18,112 acres certified. 140 of the 250 Tree Farms are listed under FFOS, with 9,595 acres managed under both programs.

The [Sustainable Forestry Initiative](#) (SFI) and the [Forest Stewardship Council](#) (FSC) – SFI and FSC provide certification programs intended to ensure that forest products come from responsibly managed forests using sustainable methods. Both organizations provide standards and certification for forest management and chain of custody, tracing the path of forest products through the supply chain. In Rhode Island, 1,783 acres of forest land are managed sustainably under FSC certification. Four Rhode Island-based companies are certified under SFI for sourcing and Chain of Custody.

Forest Resource Management

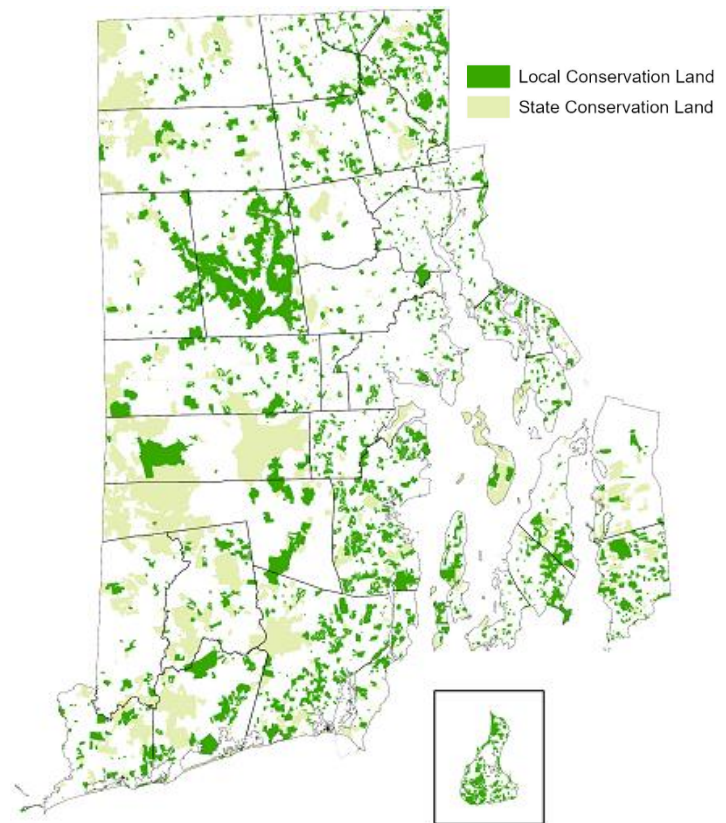
Given that much of Rhode Island's exurban and rural forests are still privately owned, they provide the greatest land area opportunity for active management. As noted previously, landowner surveys indicate that family landowners care about the value of their land for wildlife habitat, as compared to traditional uses such as hunting and cutting firewood. However, timber harvesting and other products can earn landowners' income to offset property taxes and land management costs. A lack of awareness and education may serve as an initial barrier to engaging in active management. Access to technical expertise and financial resources can also be challenges for private landowners pursuing active stewardship of their land.

Professionals or specialists are more commonly involved with managing public and institutional lands than for smaller private properties though budget levels and funding constraints can similarly limit active forest management on these larger properties as on privately owned ones. While the management of public forests typically depend on staffing and budget levels, some public and institutional owners do not actively manage their forest lands simply because there are other pressing priorities. Municipalities typically lack professional natural resources managers, resulting in forest management being a lower priority compared to other public services. This leaves management projects dependent on grants or periodic funding, and available staff to administer.

Conservation land in Rhode Island includes both small tracts and larger properties. A few large conservation organizations such as TNC and ASRI own reserves in Rhode Island, but the majority of private conservation land is held by small land trusts, many of which do not have paid staff. Therefore, conservation landowners can have much in common with smaller private landowners when it comes to land stewardship.

RIDEM's Divisions of [Forest Environment](#) (DFE) and [Fish and Wildlife](#) (DFW) manage more than 40,000 acres of state-owned forests, and the DFE is further taxed with providing services to private landowners with a field staff of 11, reduced significantly in recent years through attrition:

- 1 State Lands Forester in DFE who also works with DFW with forest management and harvesting
- 1 Stewardship Forester working with private landowners and FFOS
- 1 Forest Health Program Coordinator
- 1 U&CF Program Coordinator
- 3 staff to maintain of DFE-managed Management Area trails, roads and campgrounds
- 4 Forest Fire staff delivering training, outreach, plans and prescribed fire, and assisting DFW with prescribed fire



State and Local Conservation Land.

FOREST RESOURCE ECONOMIC IMPACT

The wood products sector and the forest-based recreation sector both derive economic benefits from forest land. Rhode Island's forest and wood products sector include commercial loggers, arborists, foresters and forestry consultants, sawmills, wood products manufacturers, wood workers, and tree farms.

One measure of active forest management is the amount of timber harvesting on forest land. Net growth in Rhode Island's forests exceeds removals from timber harvests, according to [Forests of Rhode Island, 2017](#):

Annual net growth of live trees ≥ 5 in d.b.h. (thousand ft ³ /yr)	14,811
Annual mortality of live trees ≥ 5 in d.b.h. (thousand ft ³ /yr)	6,419
Annual removals of live trees ≥ 5 in d.b.h. (thousand ft ³ /yr)	2,939

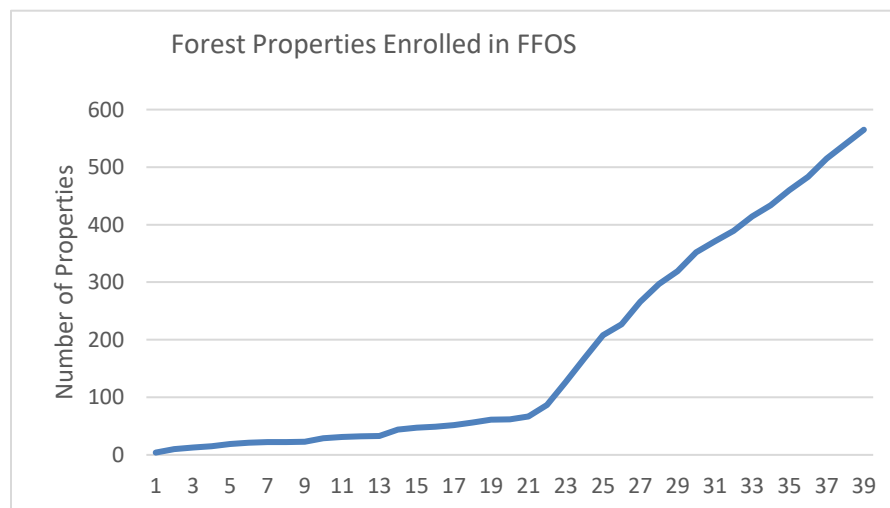
RIDEM has collected data on commercial timber harvests since 1997 through its *Intent to Cut* notification process. Over the 21-year period from 1997-2017, an average year reported harvesting on 2,068 acres, removing 3 million board feet of sawtimber and 3,824 cords of low-grade wood per year. The average harvest occurred on 33 acres and yielded 56,000 board feet and 71 cords. The *Intent to Cut* data indicates low levels of active forest management on private lands, suggesting several possible issues:

- lack of financial and technical knowledge barriers
- lack of markets
- lack of interest or awareness of the potential benefits.

Rhode Island's forest-based economy does not receive the same support or attention that other agricultural-based businesses do, even though the forest industry and forest products are considered an agricultural commodity. For example, the [Local Agricultural Seafood Act](#) (LASA) funded through a public/private partnership between the state and three private foundations, created a small grant program to support the growth, development, and marketing of local food and seafood in Rhode Island by providing farmers with funding for equipment, organizational capacity-building, and marketing of their operations. Absent from the LASA is support for Rhode Island's local forest-based products industry.

The [Farm, Forest, and Open Space](#) (FFOS) Program, which offers lower tax assessment based on current land use, is the main support for forest landowners. Managed through the Forest Stewardship Program, the forest land component of the FFOS allows local governments to reduce property taxes for forest landowners who implement an approved Forest Stewardship or Forest Management Plan. Interest in this program has increased as property tax assessments increase.

Of the 2,500 eligible landowners (with forest land of 10 acres or more) who can enroll in the FFOS current use tax program under Forest Land Classification, 571 are currently enrolled. As of 2019, over 45,549 acres are managed by private landowners through this program. This does not include adjacent forest land on properties classified under the Farm or Open Space components of the program.



Cumulative Number of Properties Enrolled in FFOS as Forests.

More information about the FFOS program can be found in [Appendix B](#).

National, and local efforts, through NRCS and RIDEM also promote forest management on private lands. In addition, the [Forestry Best Management Practices for Water Quality Protection](#) are required to limit non-point source (NPS) pollution from forestry activities but still allow low impact timber harvesting operations on forested wetlands, riverbank wetlands, and perimeter wetlands.

Wood Products

Lumber production in Rhode Island peaked at the turn of the century with [33 sawmills](#) in operation. As late as 1988 there were [16 local sawmills](#) producing 6.6 million board feet of lumber, which decreased to six by 2003. Presently, Rhode Island has three active sawmills and eight portable sawmill operators working around the state. Although the number of local sawmills has decreased, sawmills in neighboring states, and shipment to northern New England and Canada, provide additional markets for Rhode Island forest products. An average of 3.0 million board feet of sawtimber was harvested per year from 1997 through 2017.

The principal use of harvested trees is for sawtimber, primarily industrial pallets, with the highest quality wood exported for other uses. Softwood logs are processed in state or exported while firewood production provides a market for low quality hardwood trees, harvesting over 3,800 cords per year. The sole pulp mill in Rhode Island closed in 1980 and the distance to out of state mills makes harvesting pulpwood uneconomical. Based on analysis of DFE *Intent to Cut* data (1997-2017), the average commercial harvest in Rhode Island during the last 20 years involved about 56,000 board feet of sawtimber and 71 cords of wood on 33 acres.

The 2019 [Economic Impact of Rhode Island's Forestry and Wood Products Sector](#) reported that the annual gross output of Rhode Island's forestry and wood products sector totals over \$7.2 million and employs 4,844, workers including the spillover effects across all sectors of the state economy. Employment in the forestry and logging sectors is estimated at 90 jobs with gross annual sales of 11.6 million.

Fuelwood

As discussed in the 2015 [Rhode Island Forest Based Economy](#) report, the value to the forest landowner from harvesting trees for fuelwood is very low relative to other products, such as sawlogs. Harvesting and processing firewood can be time consuming and does not yield a substantial return in the market, with firewood averaging around \$200/cord to consumers. With that being said, a [2014 report](#) compiled from census data by the US Energy Information Administration showed a 160% increase in wood used for heating in Rhode Island from 2005 to 2012. The increase may be attributed to the rise in the cost of propane and home heating oil, and the financial crisis of 2008. 2017 Census data estimates 7,145 households (1.7%) in Rhode Island using wood or pellets to heat or augment home heating (*browser search for 2017 link: House Heating Fuel Universe: Occupied housing units 2013-2017 American Community Survey 5-year Estimates*).

Specialty Products

Specialty wood products include trees, or parts of trees, that are not usually considered valuable due to the tree species or low volume. These materials can be turned into valuable products by skilled artisans using materials unutilized by traditional forestry operations. The eight portable sawmills in Rhode Island and additional sawmills in nearby states service a niche market to process trees unmarketable through traditional means into specialty forest products.

While suburbanization and the small size of most parcels make management for traditional wood products difficult for the typical Rhode Island forest owner, a [2003 landowner survey](#) reported that 1% to 5% of landowners have commercially harvested an alternative product such as maple syrup, mushrooms, floral greens, or witch hazel. Witch hazel, a shrub with astringent properties and used in the cosmetics industry, is cut and chipped, and the chips transported to the American Distilling facility in East Hampton, Connecticut for processing. The shrub regenerates readily and can be sustainably harvested for decades generating at least enough revenue to partially offset property ownership expenses.

Sugar maple, the primary tree species used to produce maple products, is not as common in Rhode Island, usually only found along roads and in association with old farmsteads. Still, there are 19 operations that process and sell maple syrup. Red maple, the Rhode Island state tree, is most commonly tapped to produce maple syrup locally, but it has a much lower sugar content and requires more processing. Norway maple, native to Europe, has been widely planted in Rhode Island as an ornamental and street tree and is commonly tapped in Rhode Island because it grows to a large size.

FOREST RESOURCES & RECREATION

Forests play an important role in outdoor recreation throughout the state, supporting both physical exercise and mental health. State Management Areas also provide numerous recreational opportunities such as hiking, hunting, fishing, camping, bird watching, horseback riding trails, etc.



Source: [2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](#)

A [2018 Parks Study](#) reported that Rhode Island Parks and Management Areas receive over 9 million visitors each year, contributing an estimated \$312 million of economic output and support for over 3,700 jobs. In a survey for the [2019 Ocean State Outdoors State Guide Plan](#), Rhode Islanders expressed a preference for a wide range of outdoor recreation resources. When asked to indicate how important it is to provide various types of park and recreation facilities, Rhode Islanders showed the greatest preference for:

- Wilderness: very important 64%
- Environmental and outdoor education: very important 58%
- Recreation at lakes and ponds: very important 51%
- Trails for nonmotorized activities: very important 50%
- Boat launches: very important 45%

State-owned Management Areas, land trusts, federal wildlife refuges, hunting clubs, and private and non-profit preserves all provide year-round access to forest-based recreational opportunities. The 2015 report [assessing the economic importance Rhode Island's forests](#) estimated that wildlife-based recreational activities contribute an estimated \$375 million dollars in sales annually to the Rhode Island economy and 1,500 jobs with an estimated \$37 million payroll annually. Fall foliage viewing is the largest contributor with 25% of the total sales, followed by: camping, hiking, wildlife viewing, snowmobiling, and downhill skiing.

According to the [2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](#), approximately 402,000 residents/non-residents participated in wildlife-related recreation (hunting, fishing, and wildlife-watching) in Rhode Island during 2011, spending an estimated \$360 million, with approximately 308,000 residents/non-residents spending \$200 million on wildlife-watching alone. The study also revealed that approximately 36% of Rhode Islanders participated in some form of wildlife-related recreation in that same year. But, as noted in the [RI WAP](#), efforts to estimate the true value of wildlife in monetary terms (not solely by income generated), as with most natural resources, have been met with limited success and significant information gaps, and research needs remain.

Revenue generated from license and permit sales for hunting and fishing, and excise taxes from sporting goods is the easiest to track. These sales support state fish and wildlife conservation programs and are leveraged to match federal Wildlife and Sport Fish Restoration Program dollars, which in turn support outdoor recreational opportunities for hunting, fishing, and boating in Rhode Island. According to [Fish & Wildlife](#), fishers and hunters purchase around 70,000 licenses, permits, stamps, and tags each year, contributing more than \$235 million to the Rhode Island economy.

Interestingly, DFE does not charge fees for the 2 campsites it manages (Backpack and Frosty Hollow). Meanwhile demand is increasing while staff availability to manage, monitor, and maintain sites is severely restricted due to staffing limitations.

Campgrounds

2017 - 326 users

2018 - 486 users

2019 - 678 users

Larger events requiring special permits:

2018 - 155 permits for 75 groups serving 5,963 participants

2019 - 175 permits for 77 groups serving 7,384 participants

ECONOMIC IMPACT OF LAND CONSERVATION

It is a common argument, in Rhode Island and beyond, that conserving open spaces and forest land decreases revenue to cities and towns by taking those properties off the tax rolls and reducing land available for development in cities and towns. The [American Farmland Trust](#) identified the three common misconceptions regarding working lands within municipal boundaries:

1. Working lands—including productive farms and forests— are an interim land use, not the “highest and best use.”
2. Property tax at the current use value (such as Rhode Island’s FFOS) gives agricultural land an unfair tax break, as opposed to its potential use value for residential or commercial development.
3. Residential development will lower property taxes by increasing the tax base.

However, numerous studies suggest that protecting forest land, farmland and open spaces can generate economic tax benefits that improve the local tax base by bringing in more revenue than is used to provide services to those properties. A [compilation of data from across the US](#) shows that community revenues benefit by having working lands, such as farms and forests, because they require less in service expenditures than residential:

REVENUE-TO-EXPENDITURE RATIOS IN DOLLARS				
Community	Residential including farm houses	Commercial & Industrial	Working & Open Land	Source
Rhode Island				
Hopkinton	1 : 1.08	1 : 0.31	1 : 0.31	Southern New England Forest Consortium, 1995
Little Compton	1 : 1.05	1 : 0.56	1 : 0.37	Southern New England Forest consortium, 1995
West Greenwich	1 : 1.46	1 : 0.40	1 : 0.46	Southern New England Forest Consortium, 1995

While Rhode Island’s data is about 25 years old, recent data compiled from MA and CT show that those trends have continued.

Although there may be short-term impacts through a tax shift for permanently protected or conserved lands, the long-term benefits have been shown to outweigh any short-term losses. Supporting working lands, and conserving greenspace has been shown to actually generate revenue benefits, through avoided service costs and by increasing value and revenue of developed property.

The idea that traditional residential or commercial development yields the highest and best use for increasing municipal revenues by growing the tax base and lowering individual property taxes is contradicted by evidence from [local communities](#). Property taxes generally increase because the cost of providing services increases for the municipality. Even new commercial development, which can bring economic growth without significantly increasing the cost of services to the municipality, tends to bring new jobs and new residents who rely on those same municipal services. Managing that growth requires a thoughtful, proactive planning approach to maximize the benefits of development for all residents. When communities are highly reliant on property taxes to fund local government and lack comprehensive planning guidelines, it is often difficult to incorporate land conservation as part of the larger development picture and managing the future character of the community.

The economic benefits of planned development that takes advantage of the benefits of conserved land and well-placed development and service corridors include:

- Open spaces are not anti-development: with planning, conserving open spaces doesn't reduce housing development, but redirects the density or the location;
- Studies have shown that [open spaces enhance community property values](#), leading to increased property tax revenue: properties located near parks and open spaces are assessed at higher rates and sell for more than comparable properties located elsewhere in the community;
- Open spaces in cities and towns contribute to the quality of life and health of residents: both an affordable tool in addressing environmental health and justice outcomes, and aiding in the achievement of meeting federal and state environmental standards; and
- As land protection and conservation increase, studies have also shown that [employment rates tend to increase](#) over the next five-year period, with jobs focused mainly in tourism and recreation sectors, with amenity-related growth likely the factor driving positive long-term impacts.

Benefits

Benefits can be described as being environmental, economic or social, but the reality is that the benefits provided often address the three types of benefits simultaneously. The exhaustive list of benefits provided by traditional and urban forests and green spaces can simultaneously calm traffic, reduce peak stormwater flows, capture particulate pollution, provide mental relief, reduce UV exposure, and improve air quality, all for pennies a day.

The benefits provided by traditional and urban forests are significant for all aspects of habitat for humans and wildlife. The comprehensive benefits are summarized well in [BANKING ON GREEN: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide](#), which compiled the economic arguments for retaining and managing [green infrastructure](#). But the benefits to human health are becoming another compelling argument for recognizing the significance of that same green infrastructure.

CLIMATE CHANGE MITIGATION

As reported in [Resilient Rhody](#), temperatures in Rhode Island have increased more than 3 degrees since the beginning of the 20th century and, according to the Newport tide gauge, sea level has risen 10 inches since 1930. The joint NOAA and RIDEM publication, [Overview of a Changing Climate in Rhode Island](#), reports that over the past 80 years, Rhode Island and southern New England have experienced a significant increase in both flood frequency and severity, including a doubling of the frequency of flooding and an increase in the magnitude of flood events. [Research](#) shows that spring is arriving sooner in southern New England, with leaf-out for trees and woody plants occurring 18 days earlier than in the 1850s.

Temperatures are projected to continue to increase, leading to a longer growing season and more extreme hot days. Climate models are predicting additional changes in the years to come. Climate change is directly increasing stress on the state's forests and also playing a role in more complex, compounding factors, as [Resilient Rhody](#) noted:

- Annual precipitation is expected to continue increasing, particularly during the spring and fall, and heavy precipitation events will occur more often. Warmer temperatures will result in more rain than snow. More rainfall during concentrated periods will significantly affect hydrological patterns, including more flooding events;
- A longer growing season, warmer temperatures, and more variable summer rain are likely to increase summer moisture stress on plants and could lead to harmful droughts;
- As the climate changes, the composition of the forest will change, becoming less favorable to species that are adapted to cold climates, promoting typically southern species at the northern edge of their range;
- Warmer winters with fewer periods of sustained cold weather may lead to increased activity of forest insects and pests that have the potential to cause greater impacts to forests, as well as migration of more southerly pests as conditions become more favorable; and
- Changes in the timing of leaf-out, flowering, and fruiting in plants can be very disruptive to plant pollinators, seed dispersers, and migratory wildlife.

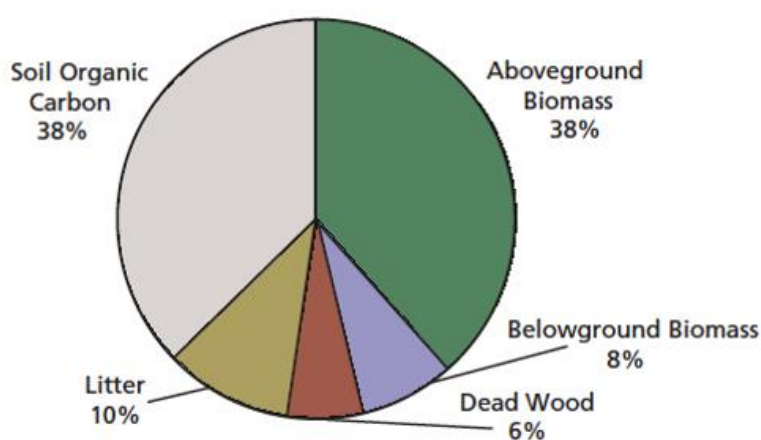
Green spaces, whether managed, unmanaged, or built, are increasingly acknowledged as essential for their contribution to the mitigation of climate change. A 2017 study by The Nature Conservancy scientists, [Natural Climate Solutions](#), found that natural and working lands have the capacity to provide 37% of the mitigation needed between 2017 and 2030 to keep global temperature rise below 2 degrees Celsius. The researchers examined strategies that are available now, scalable, cost-effective, and provide other benefits to communities. Of all possible pathways to achieve this result, the study found that trees have the greatest potential to cost-effectively reduce carbon emissions with avoided conversion of forests to other land uses, representing a quarter of the economic carbon reduction potential.

In 2016, the [Rhode Island Greenhouse Gas Emissions Reduction Plan](#), prepared by the Executive Climate Change Coordinating Council, advised that meeting the state’s emissions goals could be compromised by continued loss of forested land and recommended exploring a “no net-loss of forests” policy. The 2018 Statewide Climate Resilience Action Strategy ([Resilient Rhody](#)) identifies forests as a natural system that provides crucial services to communities and recommends that Rhode Island protect remaining forest cover, especially large, unbroken tracts of forested land, and support the development of Forest Management Plans to guide landowners in healthy forest management practices.

CARBON STORAGE

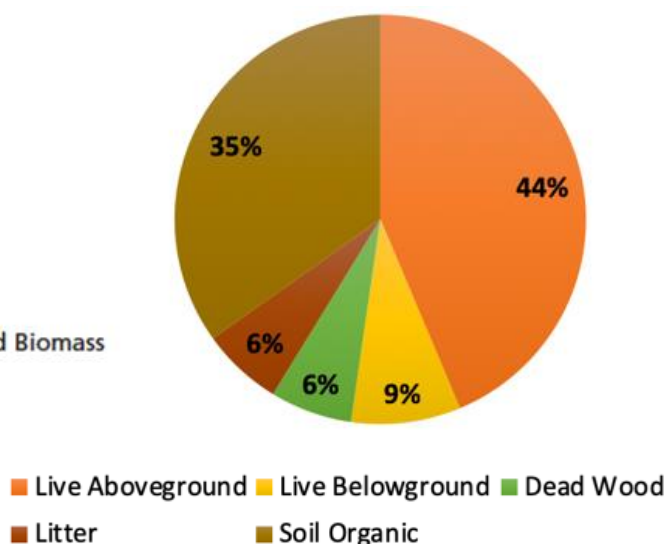
Discussions about forest carbon storage typically considers the above ground component of carbon sequestration. However, forest soils are a highly important but often overlooked carbon sink. Minimizing heavy soil disturbance and conversion to other land uses is key to maintaining carbon storage in forest soils.

A [2007 literature review and public data analysis](#) by the Forest Stewards Guild reported that an average acre of Northeastern forests hold 75 metric tons/acre (t/ac) of carbon. Of this total amount, over 1/3 of the carbon stored is found in aboveground biomass, over 1/3 in the soil itself and the remaining ~25% is composed of roots, standing and fallen dead wood, and leaf litter.



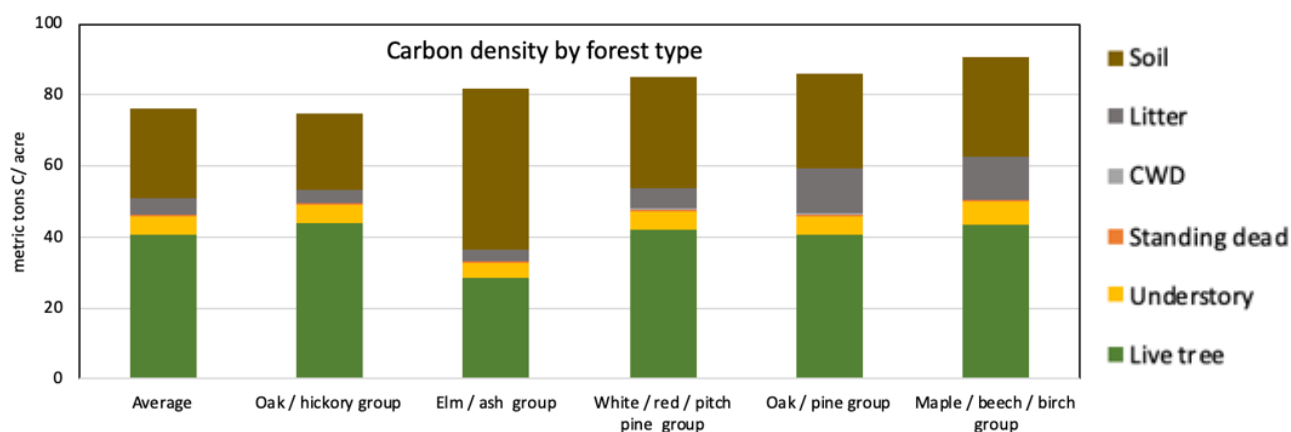
Northeast Forest Carbon Stocks.

Source: Forest Stewards Guild: [Climate Change, Carbon and the Forests of the Northeast](#)



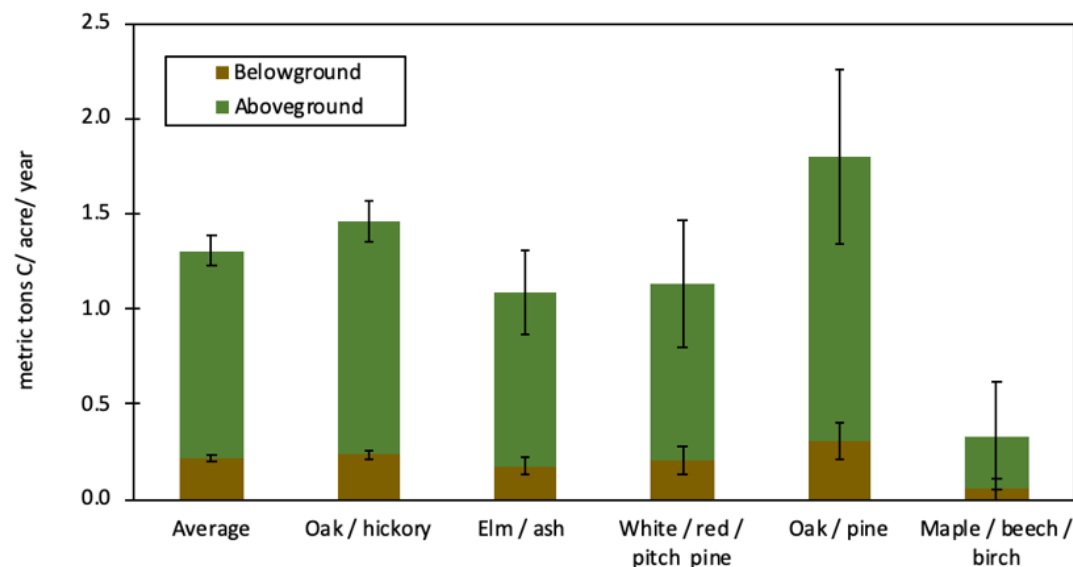
Rhode Island Forest Carbon Storage. Source: FIA Data

The [Forests of Rhode Island, 2017](#) report estimated that Rhode Island has an above ground biomass of 26.1 million tons. There are limitations to extrapolating regional forest carbon data for Rhode Island, since it is impossible to take the state out of its larger regional context. The latest data for Rhode Island show that the Northeastern percentages are relatively consistent with state-specific data, calculated using the using the [Forest Inventory and Analysis Program](#), [Forest Inventory EVALIDator](#), with an average acre of Rhode Island forest across all forest types storing 76 metric tons of carbon per acre as shown below:



Statistics for Forest Carbon Density (Storage) Among Different Forest Types. Source: [The Value of Rhode Island Forests](#)

Carbon storage varies not only by species, size, maturity, and growth rate, but can also be related to soil type and depth. The different forest types in Rhode Island, which reflect growing site characteristics, may have an average carbon density (or storage) of 76 metric tons per acre across the state (a range of 75-91).



Annual Carbon Sequestration by Forest Type. Source: [The Value of Rhode Island Forests](#)

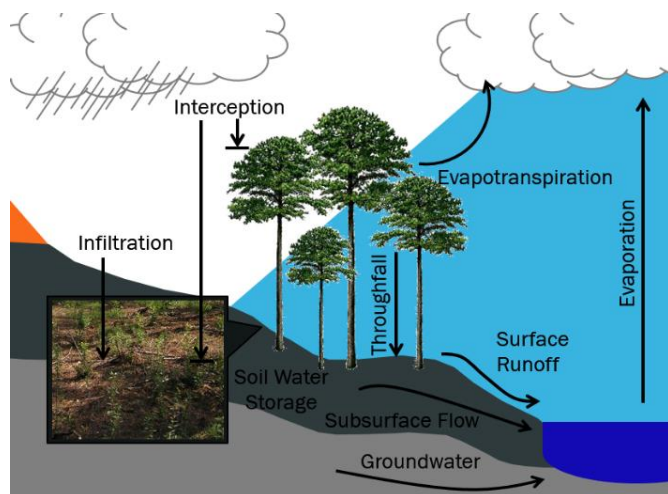
The average acre of Rhode Island forest absorbs 1.3 metric tons of carbon per year from the atmosphere. The roughly 367,000 acres of forest land in Rhode Island sequester nearly 500,000 metric ton of carbon dioxide each year. Collectively, Rhode Island's forests offset the annual emissions of more than 100,000 passenger vehicles each year (EPA [Greenhouse Gas Emissions from a Typical Passenger Vehicle](#)), equivalent to a significant percentage of Rhode Island passenger vehicle emissions. Available transportation statistics indicate that nearly 429,000 automobiles (not including buses, trucks, etc.) were [registered in Rhode Island in 2016](#). This suggests that the state's forests are capable of offsetting roughly one quarter of the annual emissions of the state's registered passenger vehicles.

Additional information on the carbon sequestration using the [Forest Inventory EVALIDator web-application Version 1.8.0.00](#) is in [Appendix C](#).

STORMWATER MITIGATION

Rhode Island relies on surface reservoirs and groundwater for potable water supplies; land use influences water quality for both sources. Forests serve as natural filters and are the most effective land cover for maintenance of water quality and quantity, providing a quantifiable economic benefit by filtering sediments and other pollutants from the water in the soil before it reaches a water source, thereby reducing treatment costs. Maintaining forest cover and practicing forest stewardship help ensure cleaner water is available from water supply sources.

The impact of forest loss and, most notably, permanent land conversion from [green infrastructure](#) to grey infrastructure or developed uses, is particularly dramatic for stormwater flow. The loss of soil permeability due to the installation of hardscape and changes in site gradient requires costly stormwater management systems that need long-term maintenance and are not built to withstand increasingly frequent 100-year events.



Precipitation Movement in the Landscape.

Source: [How Trees & Forests Really Affect Stormwater](#)

Impeding the infiltration of water into the soil and subsurface flows keeps stormwater on the surface where peak flows and flow rates are increased, leading to more frequent and more damaging flood events. Stormwater management planning to include the retention of natural areas and trees in the built landscape provide mitigation of storm flow. Even seemingly positive efforts to encourage alternative energy sources can have a negative impact on water movement in the landscape, when trees are cut, topsoil is removed, land is graded and compacted, and equipment is installed.

While much of the western part of Rhode Island is forested, the higher population and densely urbanized areas of the state are in close proximity to water, whether Narragansett Bay or the many rivers that flow through the state.

Providence, shown on the right, is a local example of the high percentage of hardscape and impervious surfaces typical of the dense urban development in the eastern area of the state. The area in pink shows the extent of impervious surfaces. Here water is unable to infiltrate into the soil and precipitation washes pollutants, oils, and trash into storm drains and waterways.



The effects of impervious surfaces were evident in Rhode Island in 2010 when heavy rains impacted the lower Woonasquatucket River, where the river corridor flows through a densely developed landscape. The lower river valley experienced dramatic flooding that led to evacuations, property damage, and loss of business. A major component of the [Woonasquatucket Vision Plan](#), a recent project of the City of Providence and the Woonasquatucket River Watershed Council, is to [restore](#) green infrastructure along the river, including trees and vegetation, to improve the natural capacity to absorb the impact of future storms.

HUMAN HEALTH

Mental Health

Research has continued to advance, refining and quantifying our understanding of the contribution of green spaces, and trees in particular, to human health:

- [Urban Nature for Human Health and Well-Being](#): a research summary for communicating the health benefits of urban trees and green space
- [The Human Health and Social Benefits of Urban Forests](#)
- [Human Dimensions of Urban Forestry and Urban Greening](#)

Mental health support as an ecosystem service is critically needed in Rhode Island. According to the 2015 [RI Behavioral Health Project: Final Report](#), mental health statistics show that there are unmet needs for mental health support in the state, including:

- Higher state spending than the national average for behavioral health services as a percentage of state GDP, but adults reporting unmet behavioral health needs at a higher rate than adults in other New England states; and
- Children in Rhode Island are at a greater risk for developing mental health and substance use disorders than children in other New England states.

CDC resources ([High School Youth Risk Behavior Surveillance](#) and [ADHD Prevalence](#) respectively) show that 29% of Rhode Island high school students (grades 9-12) have experienced depression symptoms and 16% have seriously considering attempting suicide in the past year. Rhode Island ranks 11th among U.S. States for Attention-deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD) in children, with parent reports showing that 11.1% of children in Rhode Island currently have the disorder.

Utilization of Rhode Island's natural areas is highly valued. Increasing access and exposure to green space in urbanized areas is a priority and is supported by recommendations in the [RI Behavioral Health Project: Final Report](#) to shift mental health treatment away from costly, reactive services and towards evidence-based, community-centered strategies for promoting and managing mental health care. Given the many values that forests, and other green spaces, provide to Rhode Island communities, maintaining forests to support mental well-being should be part of a community-centered health care strategy.

Physical Health

The benefits of forests and green spaces extend beyond mental well-being to physical health. The Rhode Island Land Trust Council has adopted a [program](#) that encourages people to take walks and spend time outdoors in nature for their health. The Council is partnering with the healthcare community to “prescribe” walks through this “[Park Rx](#)” program and to raise awareness about the connection between forests and other natural areas and human health.

DfE is a partner in the American Forests project, [Urban Forests for Climate and Health Initiative](#), to develop tools that assist communities to address the issues of climate and public health. The project, funded by the Doris Duke Charitable Foundation, is developing a Tree Equity Score and a GIS-based decision-support tool that uses urban forestry to reduce the impacts of climate change and to improve public health outcomes. Rhode Island's Department of Health and the [Health Equity Zones](#) (HEZ) are also involved in this effort, as is the USFS [Northern Institute of Applied Climate Science](#) (NIACS).

AIR QUALITY

Air quality also plays a significant role in health outcomes. National air quality standards were established by the US Environmental Protection Agency (US EPA) under the federal [Clean Air Act](#) in order to maintain safe levels of “criteria pollutants” that include ozone, particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead.

RIDEM's [Division of Air Resources](#) monitors air quality in Rhode Island via a network of monitoring stations and submits an annual air quality report to the US EPA. Most criteria pollutants have remained within the safe levels, but the [2018 RI Annual Monitoring Network Plan](#) reported that measured ozone levels have exceeded safe standards in Rhode Island in recent years. According to the [2019 State of the Air](#) report by the American Lung Association, all three reporting counties in Rhode Island (Kent, Washington, and Providence Counties) received failing grades for air quality based on high ozone days.

Research shows that air pollutants have been shown to have a range of negative, and compounding, impacts on human health:

- [A Framework for Examining Social Stress and Susceptibility to Air Pollution in Respiratory Health](#): The impact of air pollutants is exacerbated in low-income communities, where its impacts are often concentrated and combined with other social stressors.
- [Outdoor Air Pollution and Asthma](#): Poor air quality has been linked to asthma exacerbation and onset.
- [The medications that change who we are](#): Medications used to treat asthma are sometimes associated with behavioral changes, e.g. an increase in hyperactivity and the development of ADHD.

According to [RIDOH data](#), Rhode Island has the ninth-highest prevalence of children with asthma, 10.9%. According to self-reported data collected by the [Henry J Kaiser Family Foundation](#), more than 1 in 10 adults (12%) in Rhode Island had asthma in 2018. Black and Hispanic children are more likely to visit the emergency room or to be hospitalized due to asthma. Medical conditions caused by air pollution, like asthma, come with significant costs to quality of life and economic costs to afflicted individuals and the local medical system. A 2017 study published in the [Annals of the American Thoracic Society](#) reported that the economic cost of asthma is \$3,266 per asthmatic person per year.

Trees contribute to cleaner air by absorbing gaseous pollutants through leaf stomata and intercepting particulate matter on tree surfaces, including carbon monoxide, nitrogen dioxide, ozone, lead, sulfur dioxide, and particulate matter. Even with the variability in absorption among species, the emission of volatile organic compounds (VOCs), and pollen production, trees have an overall positive impact on human health. [Recent research](#) is showing that trees planted in urban areas, even when still relatively small, have an impact on air pollution.

A 2014 [i-Tree Canopy](#) assessment of all 39 municipalities in Rhode Island estimated that Rhode Island's entire population of trees (natural areas, green spaces and urban trees) provide more than \$30 million annually in pollution removal benefits. Trees in Rhode Island remove an estimated 13,800 tons of dangerous air pollutants from the atmosphere each year. The value of pollution-removal provided is greater than \$38 million annually when considering the removal of carbon monoxide, nitrogen dioxide, ozone, and small and large particulate matter (not including the benefits of carbon dioxide removal). While a large portion of Rhode Island is considered [rural](#) and may not actually see \$38 million in pollution removal, the benefit to the region as a whole is significant. It is where dense and healthy tree cover is located closer to pollution sources and to population centers that trees can provide the most pollution-removal benefits to the most people.

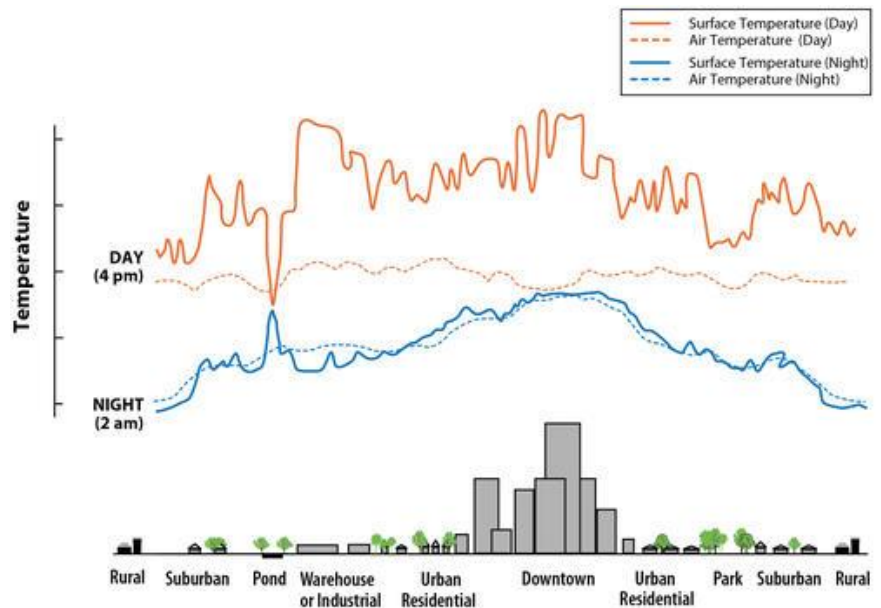
Published in 2013, [Tree and forest effects on air quality and human health in the United States](#) assessed 2010 data for air pollutants, but did not include large particulate matter (between 2.5 and 10 microns). Researchers calculated that Rhode Island trees removed 10,500 tons of air pollutants, to a value of \$33.6 million in avoided human health costs. This includes 2,900 tons of pollution removed by trees in Rhode Island's urban land (\$27.9 million value) and 7,600 tons of pollution removed by trees in the state's rural land (\$5.7 million value).

TEMPERATURE MODERATION & URBAN HEAT ISLAND MITIGATION

Forest cover plays a significant role in moderating local temperatures; the combination of shade and transpiration cooling the air can reduce temperature extremes. [Development and refinement of modeling tools](#) are valuable to effectively assess and communicate the impact of trees: a large tree can transpire as much as 100 gallons per day in a hot, dry climate, providing the cooling equivalent of five air conditioners running for 20 hours.

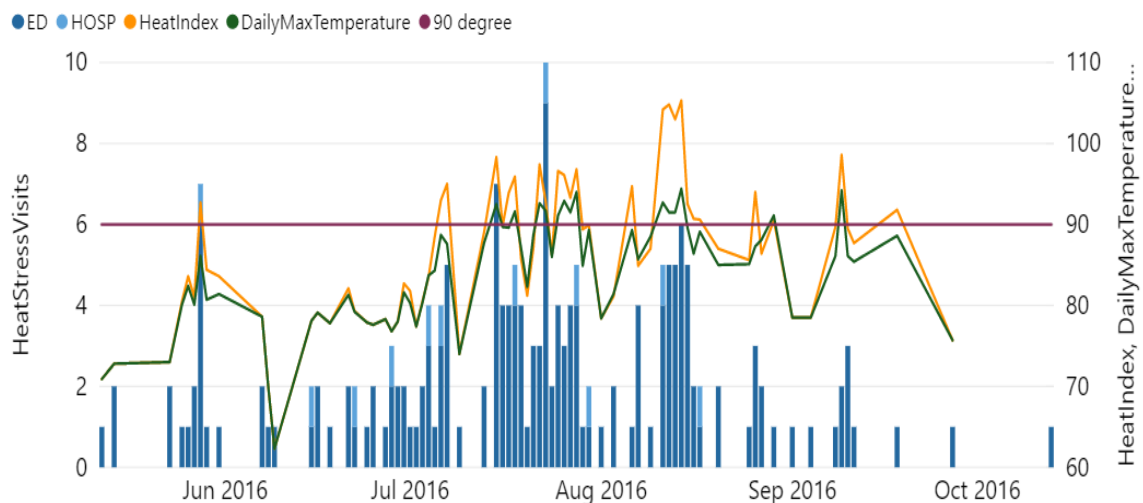
Urban areas, with their dense development and grey infrastructure, are warmer than greener areas both in the daytime under direct sun, and at night when the stored heat is released. This [urban heat island effect](#) increases energy use, mainly through air conditioning cooling, as well as affecting air quality.

[Research](#) shows that electricity demand for cooling increases 1.5–2.0% for every 1°F (0.6°C) increase in air temperatures, starting from 68 to 77°F (20 to 25°C), suggesting that 5–10% of community-wide demand for electricity is used to compensate for the heat island effect. Meanwhile, a 2010 study on [urban greening to cool towns and cities](#) estimated a 2°F reduction in ambient air temperature for every 10% increase in urban tree canopy.



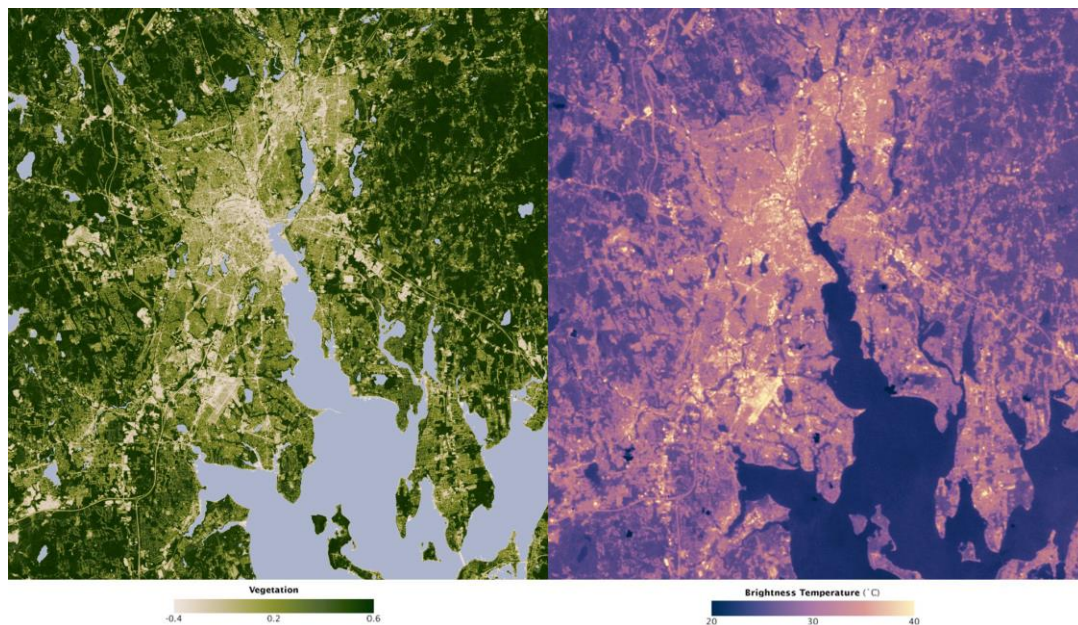
[Heat Island Impacts](#). Source: USGS.gov

High temperatures are associated with negative health impacts, including heat cramps, exhaustion and stroke, and even heat-related death. Data from the Rhode Island [Department of Health](#) (DOH) shows that this relationship between [extreme heat and negative health outcomes](#) is borne out at the state level – emergency department and hospital visits spike as temperatures increase.



[Rhode Island Heat Index Compared to Emergency Room and Hospital Visits](#). Source: RIDOH

A 2002 NASA report on [Drivers of Urban Heat Islands](#) used satellite imagery to demonstrate the relationship between acute heat island effects and vegetation. The results for Providence, shown below, displayed the expected inverse relationship between temperature, shown on the right, and vegetation, on the left.



Satellite Images of Vegetation and Temperature in Providence, Rhode Island. Source: [NASA](#)

Low-income communities are those often most acutely impacted by the urban heat island effect. The DOH [Climate Change Program](#) partnered with Rhode Island's [Health Equity Zones](#) (HEZ) in 2019 to identify places in the state's HEZ with an above average risk for heat-related illness during extreme heat events. This understanding of where increased temperatures will most impact human health can direct resources and outreach to these communities. Increasing and maintaining green space and access to green space is a logical part of any solution to address the dangerous effects of extreme heat.

Since 2015, DFE and the Arbor Day Foundation have partnered to deliver the State's [Energy-Saving Trees](#) program. This popular program funds the annual distribution of 2,000 tree saplings to homeowners to help them conserve energy, reduce utility costs, and mitigate stormwater runoff while beautifying their neighborhoods.

WILDLIFE HABITAT

The state's varied soil, vegetation and hydrology support almost 100 natural vegetative communities that support a wide range of wildlife. According to the 2015 [RI WAP](#), Rhode Island supports 92 species of mammals, 431 species of birds, 306 species of fish (freshwater and saltwater), and 36 species of amphibians and reptiles; 236 are considered to be [Species of Greatest Conservation Need](#) (SGCN) in Rhode Island.

For many of these species, forests provide the necessary habitat required for robust and resilient populations. Of the [84 key habitat profiles](#) identified, 21 are forest types, from pitch pine barrens and maritime forest, to forests representative of the Appalachians in the south or the Laurentians in the north, and the familiar oak forests of the northeast. Not only is this range of forest types needed to support the multitude of wildlife species, but age class diversity is also necessary. As noted earlier in this report, the percentage of young (0-20 years) and old (>100 years) forests is very low in Rhode Island. So, while there may be an increase in the upper age classes if harvesting levels remain low, the lack of early successional

stands requires management intervention by DFW and DFE working together, and the development of tools such as the [silvicultural recommendations for supporting bird habitat](#) that target landowners and consulting foresters are needed.

The distribution and abundance of Rhode Island's forest dwelling wildlife is affected by the characteristics of the forest cover and their specific requirements. Some of Rhode Island's forest dwelling creatures are generalists and can be found in a variety of habitats, including human habitats periodically or seasonally, while others are specialists requiring a single habitat type or a much-reduced variability, and thus are far more susceptible to changes in forest cover. And, while some species can get by with fragmented patches interspersed with development, area-sensitive species need large, unfragmented forest blocks to thrive.

Examples of species that have grown accustomed to human proximity and proven more adaptable in fragmented landscapes include white-tailed deer treating the suburbs as a buffet, rose-breasted grosbeak using suburban feeders during migration, and red foxes and coyotes using local green spaces and taking advantage of intentional and unintentional human subsidies.

Examples of species needing large patches of intact forest to thrive include northern goshawk, scarlet tanager, red-spotted newt, marbled salamander and, because they depend upon increasingly rare cold-water streams for survival, brook trout.

Some species require young forests, or a matrix of older forest and more open habitats (which may or may not include young forest), but landscape fragmentation by roads and other development can be highly detrimental to such species as New England cottontail, Eastern box turtle, woodcock, and numerous songbirds.

Still other species are even more specific, relying on only one or a few host plants to complete their life cycle, such as the state-threatened frosted elfin butterfly, which relies on wild indigo or wild lupine, and the state-concern sleepy duskywing, whose host plant is scrub oak. Given that these plant hosts are found in the pitch pine woodlands and barrens, the decrease of that forest type to about 1/5th of their original range through land conversion means that any further loss of that forest type is a significant concern.

Rhode Island's wildlife needs forests of all stages, and the state's human residents benefit from robust and healthy wildlife living in those habitats. Wildlife resources play a direct and critical role in how the ecosystem functions through the complex services that they provide to humans and the landscape. Pollinators (not only bees but birds, moths, butterflies, wasps, flies) are critical in the reproduction process of countless plants including those important to human food systems. According to the [Food and Agriculture Organization of the United Nations](#), three out of four crops across the globe producing fruits or seeds for human use as food depend, at least in part, on pollinators. As noted in [The Value of Rhode Island Forests](#), other beneficial wildlife species include birds, mammals and insects dispersing seeds through their movements and droppings; and squirrels inadvertently planting trees by forgetting where they buried their acorns. Even the less charismatic species have a role to play: all resident bat species are insectivores; scavengers, like the turkey vulture, clean up roadsides by consuming road killed animals; and the lowly opossum's diverse diet includes insects, beetles, ticks, and roadkill.

ISSUES, THREATS & OPPORTUNITIES

The *Rhode Island 2020 State Forest Action Plan: Assessment* has identified five *issues of concern*. These priority issues also present challenges to existing DFE capacity, but all five Cooperative Forestry Programs recognize their significance to a viable and resilient forest and address these issues within their strategies and program delivery.

The priority issues, or issues of concern, are:

1. **Forest loss, fragmentation and parcelization** – wildlife habitat, landscape functionality, interface and intermix, and invasive species
2. **Forest health** – invasive plants, wildlife habitat, diversity and resiliency, pests and diseases
3. **Water** – stormwater, riverine/wetlands, water quality
4. **Fire** – increasing intermix and expanding interface combined with increasing fuel loading
5. **Climate change** – changes to species distribution and sites, increased disturbance, exacerbation of forest health threats, phenological mismatches

It should be noted that fragmentation exacerbates the issues that threaten Rhode Island's forests or impact its management and response for the priority issues two through five. Fragmentation is an underlying issue that contributes to, speeds, and intensifies the rate of change, the severity of conditions, and the exposure of forest types and habitats to these threats. Therefore, although fragmentation is addressed as the first priority issue, it will also be referenced as a factor in the discussion of Forest Health, Water, and Fire as priority issues. Climate change is also a driver impacting forest resiliency and the rate of change, further complicating forest management and planning.

RELATIONSHIP TO NATIONAL PRIORITIES

The Priority Issues for Rhode Island incorporate the National Priorities and are addressed in the *Rhode Island 2020 Forest Action Plan: Strategies* section.

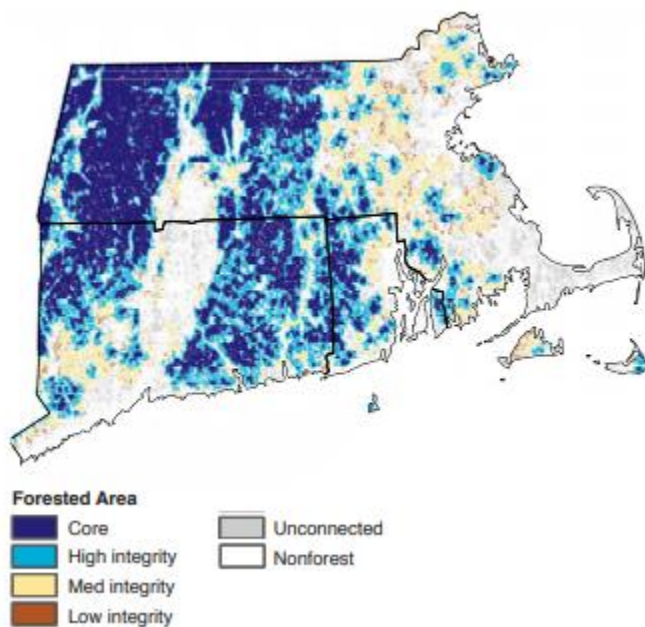
1. **Conserve** and Manage Working Forest Landscapes for Multiple Values and Uses
Forest landscapes, whether under public or private management, must be conserved to protect landscape functionality, habitat, and environmental benefits.
2. **Protect** Forests from Threats
Rhode Island's forests face threats on multiple fronts: development leading to the loss and fragmentation, ease of spread of invasive plants and pests/diseases, loss of habitat, loss of economic and environmental benefits, and wildfire risk.
3. **Enhance** Public Benefits from Trees and Forests
Support and promote the management and retention of forest lands for multiple benefits: water and air quality, carbon sinks and sequestration, temperature moderation, forest products, wildlife habitat, etc.

RI SFAP Priority Issues	Conserve	Protect	Enhance
Fragmentation	✓	✓	✓
Water			✓
Fire	✓	✓	✓
Forest health	✓	✓	✓
Climate Change		✓	

Issue: Fragmentation

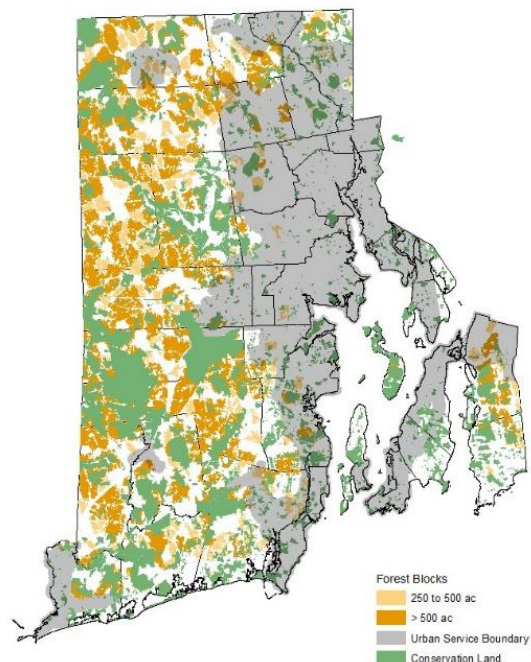
According to a 2015 [study](#), 70% of the world's trees are within 1 km (0.62 miles) of the forest edge. The study authors concluded that "Fragmentation experiments—some of the largest and longest-running experiments in ecology—provide clear evidence of strong and typically degrading impacts of habitat fragmentation on biodiversity and ecological processes." Established well beyond anecdotal observations, "habitat fragmentation reduces biodiversity by 13 to 75% and impairs key ecosystem functions by decreasing biomass and altering nutrient cycles." The impacts of fragmentation are a major threat to the species of greatest conservation need (SGCN) identified and addressed in the [RI WAP](#), and are a consequence of human habitation and infrastructural needs. As populations grow and demand continues to increase, the resulting subdivisions, roads, utility corridors, and transmission installations result in smaller and smaller parcels with less and less connectivity, impacting the movement and subsequent genetic diversity of plants and animals, and removing necessary habitat for species with specific interior forest requirements.

Fragmentation is not only impacting Rhode Island it is a national and regional issue as well. However, the compact size of the state means that there is less area available that could be retained as core forest (i.e. blocks of unfragmented forest 250 acres or larger):



Forest Land Integrity in Rhode Island, Massachusetts, and Connecticut. Source: [The Forests of Southern New England, 2012](#)

The impacts of fragmentation are a major contributor to the number SGCN in Rhode Island. Fragmentation of forests into smaller patches reduces the value of these habitats for forest interior species, which is reflected in the 236 SGCN. The map and text on the right shows the distribution of blocks greater than 500 acres in size and illustrates the degree to which forests have been fragmented in Rhode Island. Not only are the biological process altered, but the economics of forest management, and increase in decision makers, make it more difficult to educate landowners and coordinate management on the landscape. This can cause numerous issues:



Forest Blocks by Area.

Percent Intact Habitat Core Area



STATE

9.7x
more roads than
streams in this state
(National Avg: 5.5)

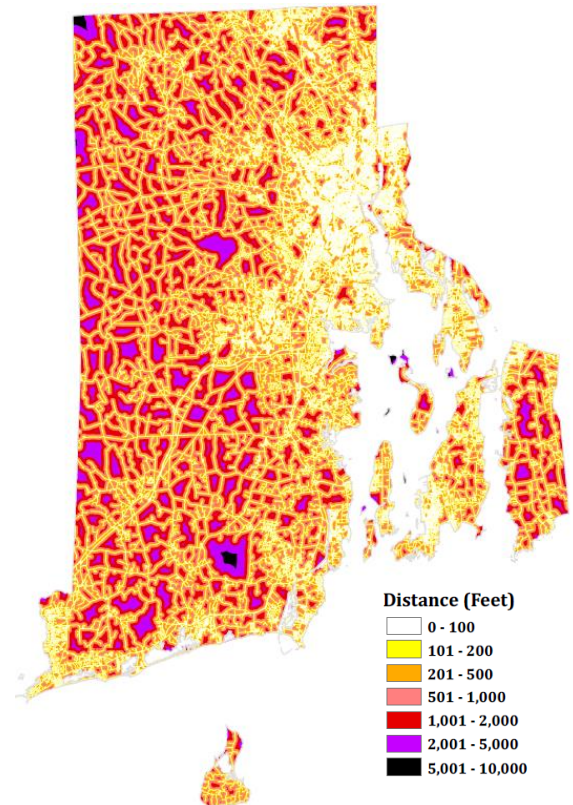
Source: [ESRI Green Infrastructure Strategy](#)

- Opening intact natural habitats to invasive species
- Increased wind & erosion potential
- Windthrow on the newly exposed edges of forest stands
- Loss of interior forest species
- Loss of diversity, and
- Economically, can result in forested areas too small to manage for harvest

A 2019 GIS research brief by the University of Rhode Island, [Loss of forest in large unfragmented blocks of forest in Rhode Island](#), identified significant loss of forest within large, previously unfragmented blocks of forest greater than 250 acres. These blocks of remaining core forest were mapped by RIDEM during the preparation of the [RI WAP](#). The URI analysis compared statewide aerial imagery of forest cover in 2011 and 2018. Over the seven-year period, 1,914 acres classified as large, unfragmented forest in 2011 were converted to non-forest use, with most of the forest conversion occurring as small, scattered patches. Moreover, 66% of the forest loss (1,267 acres) occurred within blocks larger than 500 acres, which are particularly valuable for wildlife habitat.

Another way to estimate forest fragmentation is the distance to the nearest road from a given point. URI researchers performed a statewide analysis with RIGIS land use classification data (based on a 30m x 30m pixel) and found that the mean distance to a road in Rhode Island in 2019 is only 613 feet (0.12 mile), with a standard deviation of 702 feet.

Even with a more generous interpretation of a core forest, by including locations more than 2,000 feet from a road, URI researchers found that the only mainland locations where forest blocks are large enough to be more than a mile from a road are found in DEM's Buck Hill and Great Swamp Management Areas as well as land along the Connecticut border.



Distance to Nearest Road.

Source: Peter August, Department of Natural Resources Science, University of Rhode Island

PRESSURES CONTRIBUTING TO THE BURGEONING FRAGMENTATION OF RHODE ISLAND'S FORESTS:

State Development Trends

As reported by [RI Statewide Planning](#), the conversion of forest land to developed uses in the late 20th century was higher than historic trends, increasing by 43% from 1970 to 1995: developing more residential, commercial, and industrial land during that time than in the previous 325 years. While forest loss generally occurs near urban areas and roads, the trend is changing as pressure to convert forest to residential use continues, and as pressure for the development of renewable energy threatens large forest parcels, even in more rural areas.

Building permits and aerial photography confirm that Rhode Island's recent development continues to follow sprawling land use patterns, and forest acreage continues to decline as land is developed. A USFS

report on forest statistics ([1985 and 1998](#)) noted a decrease in timberland area of 9% from 1985 to 1998. A similar decrease between 1998 and 2007 means that Rhode Island had the [greatest forest loss in southern New England](#) in that timeframe.

Renewable Energy Demands

The desire for energy independence has also fueled forest conversion. Rhode Island's [Clean Energy Goal](#), calling for 1,000 megawatts of solar energy by 2020, has created a demand for large parcels of land to site ground-mounted solar installations. The 2020 State of the State speech presented a new target: all electric energy from renewables by 2030. The opportunity for forest landowners to derive income from their property is naturally tempting and has broad implications for state forest land.

To date, 150 "solar farm" projects are generating 58 megawatts on 262 acres, a mere 6% of the projected goal. As each megawatt has required an average of 4.5 acres of land, meeting that goal through solar farm installations alone would require an additional 4,239 acres. Compared to the 1990-2010 land conversion rates of 838 acres per year, solar farms would require more than 25% of the total amount of land converted between 1990 and 2010, to achieve the 2020 clean energy goal.

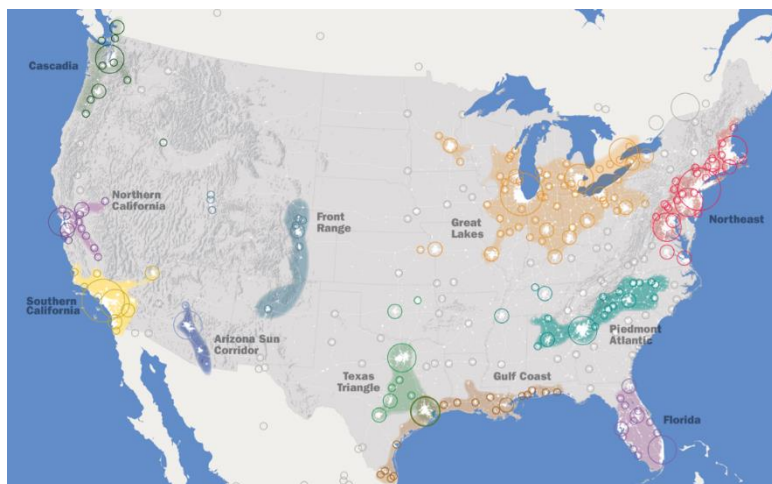
Cities/Towns	Solar Farm Projects	Megawatts generated	Total Acres Used	Cities/Towns	Solar Farm Projects	Megawatts generated	Total Acres Used
Bristol	6	0.3	1.35	North Kingstown	8	6.9	31.05
Burrillville	1	0	0	North Scituate	2	1.4	6.3
Charlestown	1	0	0	North Smithfield	6	3.2	14.4
Coventry	1	0.1	0.45	Pawtucket	1	0.2	0.9
Cranston	9	6.4	28.8	Portsmouth	1	0.5	2.25
Cumberland	4	1.8	8.1	Providence	25	4.4	19.8
East Greenwich	1	0.1	0.45	Richmond	4	7	31.5
East Providence	8	3.8	17.1	Scituate	1	5	22.5
Exeter	2	1.8	8.1	Smithfield	3	0.3	1.35
Foster	1	2	9	South Kingstown	7	1.4	6.3
Glocester	6	0.9	4.05	Tiverton	2	0.2	0.9
Hopkinton	3	0.7	3.15	Warren	1	0.1	0.45
Jamestown	2	0.2	0.9	Warwick	5	0.4	1.8
Johnston	4	1.6	7.2	West Greenwich	1	2	9
Little Compton	1	0.2	0.9	West Warwick	6	1.1	4.95
Lincoln	4	1.4	6.3	Westerly	7	0.4	1.8
Middletown	12	1.9	8.55	Woonsocket	2	0.3	1.35
Narragansett	1	0	0	Total	150	58.3	262.35
Newport	1	0.3	1.35				

The Total Number of Solar Projects in Rhode Island by Town, Acres Used, and Megawatts Generated

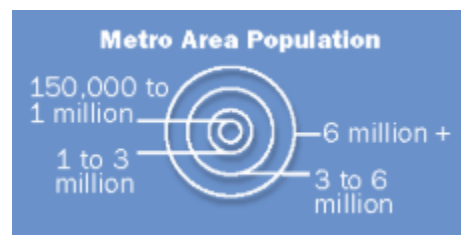
Regional Development Trends

While Rhode Island has not experienced the rapid population growth similar to other areas in the US, according to [America 2050](#), Rhode Island is a part of the Northeast megaregion, stretching from Washington D.C. to Boston, which produces 20% of the nation's GDP with 17% of the population on 2% of the nation's land area. It is predicted that by 2050 that the Northeast will add 17 million new residents over the 2010 census (from 52 million to 71).

The impact in Rhode Island is predicted as being an outward expansion from the edges of existing urban areas, infill of green spaces within urban areas, and continued dispersal of humans and their related development into the smaller communities and forested areas of the state.

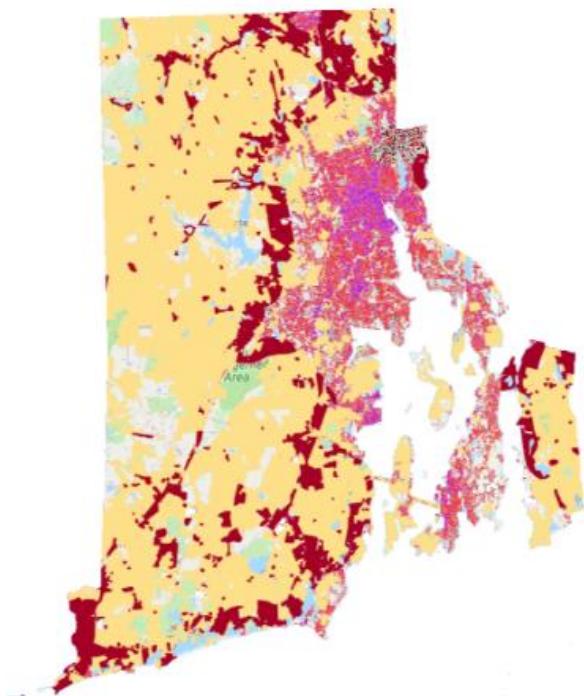


US Megaregions. Source: [America 2050](#)



Expansion of Wildland-Urban Interface & Increasing Intermix

The impact on core forest is not the only consequence of fragmentation. While Rhode Island is the 2nd-most densely populated state per capita, the western part of the state is still largely forested. Although parcel size is typically small, and tracts of forest land are surrounded by non-forest uses, the continued encroachment into the forested areas also expands the Wildland-Urban Interface (WUI).



This map, derived from the [i-Tree Landscape Tool](#), shows the Wildland-Urban Interface (WUI) in red and Wildland-Urban Intermix in yellow.

- [Wildland-Urban Interface](#) refers to a distinct area of wildland fuel adjacent to a developed area.
- [Wildland-Urban Intermix](#) refers to a specific type of wildland-urban interface in which the homes or other structures are intermixed with wildland fuels, scattered or in small groupings.

A comparison of WUI in Rhode Island in 1990, 2000 and 2010, completed by the [Silvis Lab](#) in 2013 shows an increase in the area of forest land acres designated as WUI, with an increase in housing units and population. The maps provided under Priority Landscapes (page 53 of this plan) show the change in designation of land between 1990 and 2010.

The number of housing units within the WUI increased by 20% between 1990 and 2010 (below).

HOUSING UNITS		1990	2000	2010	1990%	2000%	2010%
Rhode Island	WUI	114,310	128,646	142,751	27.6	29.2	30.8
	-Intermix	49,555	57,005	63,127	12.0	13.0	13.6
	-Interface	64,755	71,641	79,624	15.6	16.3	17.2
	Non-WUI	300,262	311,191	320,637	72.4	70.8	69.2
	TOTAL	414,572	439,837	463,388			

Meanwhile, in that same period, while the overall state population increased by only 5%, the population within the area designated as WUI increased by 12% (below).

POPULATION		1990	2000	2010	1990%	2000%	2010%
Rhode Island	WUI	289,689	316,066	327,152	28.9	30.1	31.1
	-Intermix	130,658	147,034	151,766	13.0	14.0	14.4
	-Interface	159,031	169,032	175,386	15.8	16.1	16.7
	Non-WUI	713,775	732,253	725,415	71.1	69.9	68.9
	TOTAL	1,003,464	1,048,319	1,052,567			

As the table below further shows, the area assessed as WUI also increased during that time, meaning not only were more people moving into forested areas, but development was occurring in new areas of forest land. This trend has continued past 2010, and is a likely contributor to the fragmentation of the largest blocks of contiguous forest (>500 acres) reported in the [RI WAP](#).

AREA (square km)		1990	2000	2010	1990%	2000%	2010%
Rhode Island	WUI	1,514	1,580	1,634	37.8	39.5	40.8
	-Intermix	1,299	1,343	1,376	32.5	33.6	34.4
	-Interface	215	237	258	5.4	5.9	6.4
	Non-WUI	2,487	2,421	2,368	62.2	60.5	59.2
	TOTAL	4,001	4,001	4,001			

Predictive models of future development, such as the [ESRI Green Infrastructure Strategy](#), use imagery that is rather coarse (30m pixels) to communicate change in Rhode Island. These models do not show change within the Wildland-Urban Intermix well, but they can show the expected development in the Wildland-Urban Interface. The ESRI predictor compares changes between aggregated 2011 National Land Cover Database land cover categories with similarly aggregated land cover categories from [The Clark Labs 2050](#)

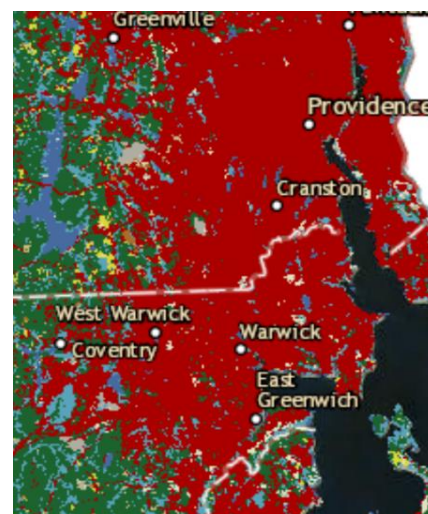
[Conterminous US Land Cover Prediction.](#)



2011

These models for future development predict the continued loss of forest, showing continued expansion from existing high-density areas in the eastern part of the state, and infill of many remaining green spaces in urban Rhode Island. Unfortunately, the 30m scale is too coarse to realistically capture/predict change in the western part of the state.

Source: [ESRI Green Infrastructure](#)



2050

Issue: Forest Health

Forest health is a broad term that can refer individually or comprehensively to the health and condition of forest types, forest succession, wildlife habitat, invasive plants, pest and disease concerns, fire fuel conditions, and future state. Forest health, through the lens of forest management, can be considered a condition where forest ecosystems sustain their complexity while, at the same time, provide for human needs.

By their very nature forest ecosystems are in a constant state of change. Even healthy forests are continually disrupted:

- Ice and snow break tree branches, destabilizing structure or opening trees to decay.
- Strong winds topple trees providing new material to decay into the soil, opening the understory to increased sunlight, releasing suppressed trees, and allowing dormant seeds to germinate.
- Native and non-native insects and diseases stress trees, resulting in decline and, often, mortality.
- Invasive plants often outcompete native species for growing space, soil nutrients and water, affecting wildlife habitat and food sources.
- Fires can disrupt forest successional stages, resetting the forest to earlier stages; or fire can revitalize ground cover and understory, enhancing habitat and plant biodiversity.

As the forest flora changes, fauna respond to the new conditions and either adapt, migrate from, or immigrate into the new forest habitat. Some wildlife populations thrive, others decline or perish. Human activity is an additional complication to the ebb and flow of forest conditions and “health”: plots are plotted and developed, resulting in fragmentation of continuous forest land; passive to intensive recreation, while encouraging an appreciation of a forest’s values, leave a distinct, and sometimes, damaging footprint on the land. Forest ecosystems are resilient and able to withstand or recover from such disruptive events provided they don’t threaten the sustainability of the ecosystem itself.

Pests and diseases, invasive plants, and wildlife habitat are not only elements reflective of forest health, but they are further impacted by fragmentation. In fact, humans are the leading contributor to the spread of forest pests and diseases, exotic invasive plant species, and degradation or destruction of wildlife habitat:

- movement of commercial goods
- transportation of firewood
- movement of plant material
- transportation corridors
- development

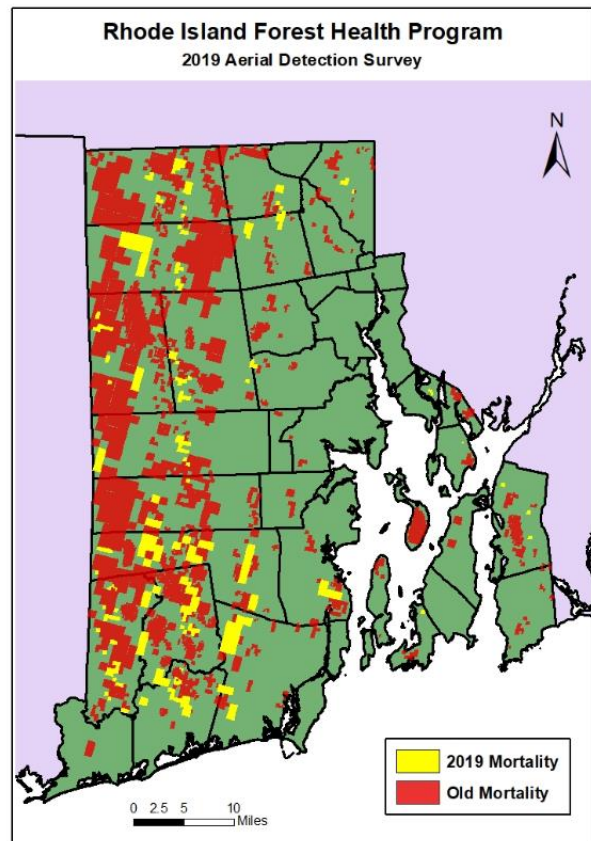
These are only a few of the mechanisms that contribute to often catastrophic impacts on forest health, forest structure, and stability. Eons of localized stand equilibrium, forest succession, structure and habitat can be undone with a single shipment of infested packing materials, infested plant material, soil, or seeds, which may ultimately disrupt entire ecosystems. Movement along transportation corridors increases ease of movement and migration of invasive species, while development and construction interfere with native plant and wildlife movement, gene flow, and resiliency.

INVASIVE INSECTS & DISEASES

Native insects and diseases are a normal part of healthy forests, but the introduction of non-native insects and diseases (even earthworms) can have devastating effects on forests. During the past 100 years, the forests of Rhode Island have been impacted by gypsy moth, chestnut blight, Dutch elm disease, hemlock woolly adelgid, and now emerald ash borer. Other non-native invasive insects, currently not present in Rhode Island, are being monitored for their spread and inevitable arrival.

Given the size of DFE with a field staff level of 11, and only one staff person within Forest Health, the capacity of the state to respond/react/treat pest and disease issues is limited. In addition, even if staffing and funding levels were suitable for the forest management needs of DFE, some actions would still not be considered appropriate, such as widescale insecticide treatment for gypsy moth. The programmatic capacity to address Forest Health is focused on meeting the requirements of the USDA Cooperative Grants Program and relies on in-state partners to assist with delivery, mainly RIDEM Division of Agriculture and the University of Rhode Island.

Aerial detection surveys are flown yearly, as needed and where budget exists. Surveys in 2019 showed mortality expanding the over 45,000 - 50,000 acres impacted by gypsy moth (2014-2018), nearly 14% of Rhode Island's forest land. Contributing factors to that continued mortality include two-lined chestnut borer, forest tent caterpillar, and residual pockets of gypsy moth. Ash mortality due to emerald ash borer is expected in future years but, due to its distribution in natural areas in Rhode Island, is not expected to have the obvious mortality margins of gypsy moth outbreaks.



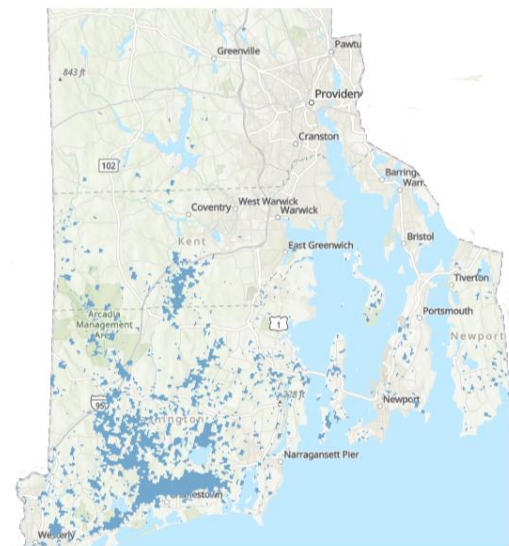
Insect Pests of Continuing Concern

Gypsy Moth *Lymantria dispar*

Gypsy moths remain as permanent residents within eastern forests and will continue to reach outbreak status periodically. Changes in seasonal weather patterns and precipitation amounts will have the greatest impact on the periodicity of outbreak occurrence. Cool April temperatures and sufficient precipitation to support the life cycle of *Entomophaga maimaiga*, a fungus that kills gypsy moth caterpillars, are necessary to maintain gypsy moth at low population levels. However, additional stressors to trees, particularly chronic ones such as drought, will continue to increase tree mortality where repeated defoliation occurs.

Southern Pine Beetle *Dendroctonus frontalis*

Trapping for the SPB continues with variability in collection numbers observed from year to year. In 2019 there was a significant reduction (92 beetles in 2018, 1 in 2019) but concern remains that an endemic population exists and has the potential to reach outbreak status. Not only will warming temperatures provide conditions conducive for SPB outbreak, but they may also contribute to chronic stress factors to Rhode Island's pitch pine (*Pinus rigida*). URI continues to collect other species of concern, as well as predators of SPB.



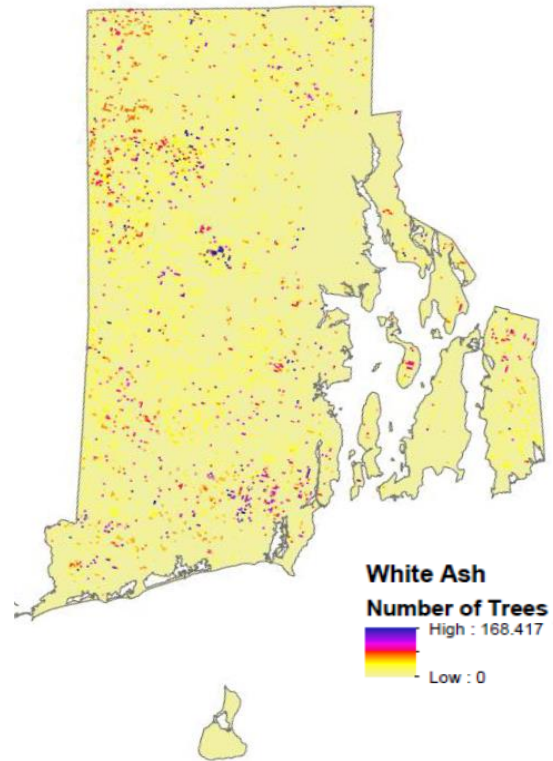
Pitch Pine Distribution.

Source: Lisa Tewksbury, URI

Emerald Ash Borer *Agrilus planipennis*

Adults were found in Rhode Island in 2018 and larvae in 2019. Given the prognosis for the spread of this pest, treatment is not a feasible option for forest trees. Individual landscape trees and trees deemed significant by the owner/manager may be suitable for prophylactic treatment for long term management. DFE provides information regarding the options on their [Forest Health webpage](#). Workshops and educational sessions for the public, communities, and green industry professionals are ongoing. Surveying and monitoring activities, mainly trapping with baited and unbaited traps, and *Cerceris fumipennis* (no common name) biosurveillance, also occur as appropriate to help determine the location and extent of the EAB population and direction of spread.

2018 FIA data indicates that there are nearly 1.4 million ash in Rhode Island, mainly comprised of white ash (1.3 million), plus green and black ash. Over 600K of those trees are less than 3" dbh. Information on ash trees in urban areas is limited to anecdotal observations of tree species planting selection. (Urban FIA data collected over 200 plots (1/2 a full cycle, 2015-2018) in Providence tallied 2 white and 2 green ash, which may not indicate municipal and private exposure to EAB at the time of this report).

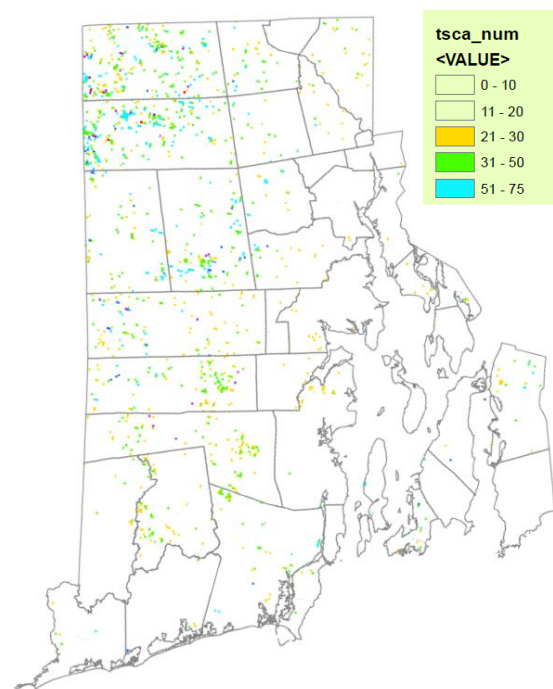


Ash Species Distribution. Source: FIA data

Hemlock woolly adelgid *Adelges tsugae*

First confirmed in Providence and Washington Counties in 1986 and Newport County in 1993, HWA is established through the southern and eastern range of Eastern hemlock and has made its way to southern ME, NH and VT. In Rhode Island, little has been done since initial insect predator research releases in the early 2000s. The hemlock population is scattered, with the largest population in the northwest of the state, including state lands at George Washington State Management Area and Campground.

Continued predatory insect research, and release and recapture of west coast native lady beetle, *Laricobius nigrinus*, from GA to MA suggests that there may be opportunities to revisit this issue. Since HWA thrives on stressed urban trees, a predator population would have a beneficial impact, reducing HWA population levels on individual, as well as forest, hemlocks.



Eastern Hemlock Distribution. Source: FIA data

Winter Moth *Operophtera brumata*

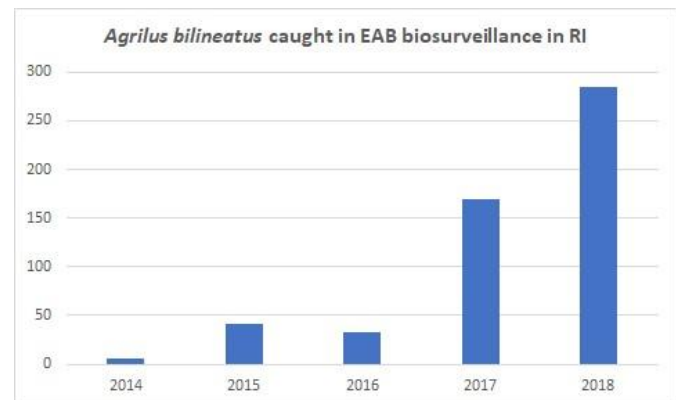
Recent years have seen a reduction in the occurrence of Winter Moth with much of the credit going to the release of a parasitic fly, *Cyzenis albicans*, 2011-2017, and as an increase of native predators and parasitic insects. Recently, URI's monitoring program is been finding it difficult to find areas with sufficient winter moths to trap and monitor. While this pest remains on the list of pest concerns in Rhode Island, the hope is that outbreaks will be localized and of short duration due to a rapid buildup of established predatory insects.



Source: Heather Faubert, URI

Monitored Insects of Concern

- Two-lined chestnut borer (*Agrilus bilineatus*) – may be contributing to post-gypsy moth outbreak mortality, specimens collected from EAB biosurveillance program increased during the 2017-2019 seasons.
- Forest Tent caterpillar (*Malacosoma disstria*) – populations rise and fall as does public concern; identifiable mortality during aerial detection surveys is periodically reported.
- Orange-striped oakworm (*Anisota senatoria*) – skeletonized leaves on host species in Providence & Kent counties occurred in 2019, but no mappable areas of defoliation/mortality were observed.
- White pine weevil (*Pissodes strobi*) – is not specifically tracked, however monitoring bycatch data suggest that populations of *Pissodes spp.* are robust; understory white pine recently released due to oak mortality may see impact in future years.
- Monitoring continues for: Cynipid gall wasp (*Bassetia ceropteroides*), Black Turpentine Beetle (*Dendroctonus terebrans*) and the exotic invasive Asian longhorn beetle (ALB) (*Anoplophora glabripennis*)



Status of Asian Longhorn Beetle Spread and Control.

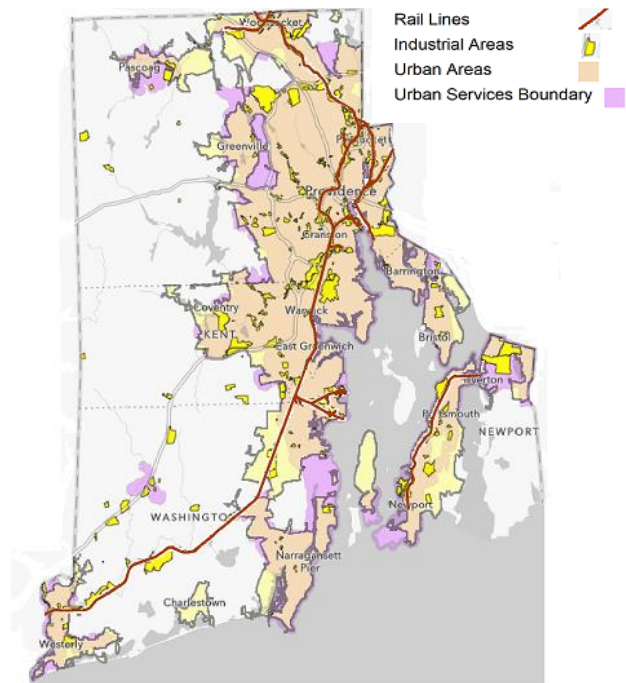
Source: [2019 National ALB Program Overview](#)

Anticipated Pests

Spotted lanternfly (SLF) (*Lycorma delicatula*)

While still only documented in mid-Atlantic states, DFE, in partnership with the Division of Agriculture has begun educating itself about SLF. SLF's impact on agricultural plants (hops, grapes and fruit trees) is a concern, but the degree of impact on forests and forest species is less clear at this time. There is a high likelihood that SLF will create a nuisance factor in residential and urban areas, requiring DFE engagement/education of the Forest Health, Stewardship, and Urban Forestry Programs.

The preponderance of the preferred host, *Ailanthus altissima*, particularly along railway lines (and former railway lines) provides a corridor for population expansion through the eastern/central portion of the state.



Transportation corridors and industrial areas conducive to transportation and introduction of invasive pests, plants and diseases, particularly spotted lantern fly.

Monitored Diseases of Concern

Monitoring/awareness continues for:

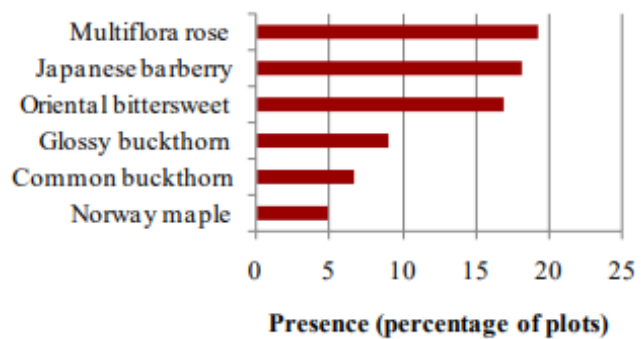
- Rhizosphaera Needle Cast (*Rhizosphaera kalkhoffii*) – a disease of spruce, commonly seen on stressed landscape trees.
- Oak anthracnose (*Apiognomonia errabunda*) – periodic; associated with wet springs that promote *Entomophaga maimaiga*.
- Beech bark disease (*Nectria coccinea* var. *faginata* or *Nectria galligena* vectored by *Cryptococcus fagisuga*) – present throughout the state but limited in number of trees affected and observed mortality at this time.
- White pine blister rust (*Cronartium ribicola*) – considered nearly eradicated in the eastern US, has seen a resurgence and is a rising concern; understory white pine recently released due to oak mortality may see impact in future years.

INVASIVE PLANT SPECIES

Invasive (i.e. introduced) pests and diseases can thrive because of either: 1) a lack of genetic resistance or evolved response tactics by native local species to attack and infestation; or 2) a lack of predators or organisms that can attack and overcome introduced pests. Invasive plant species, on the other hand, typically outcompete native species through processes that include high seed yield and seed movement, seed banking, allelopathy, clonal growth, and aggressive rooting. These processes give invasive plant species a competitive advantage in the fight for colonization, growth, and dispersal. Invasive plants can overwhelm native plant communities and reduce biodiversity of the native plants and the wildlife that relies on them – especially when an area is disturbed, cleared, or developed – and can have significant ecological and economic impacts. Land development, urbanization, and fragmentation exacerbate the introduction and spread of invasive plants.

In 2015, almost half (48%) of all invasive species identified in the [RI WAP](#) were associated with forest edge habitat and were listed as a top threat to Rhode Island's key habitats. Included was information from the report [Identifying relationships between invasive species and species of greatest conservation need](#), which

identified 238 non-native species with the potential to adversely impact species of greatest conservation need (SGCN) in the Northeast, and 68% of these were invasive. According to the [Forests of Southern New England, 2012](#), the most common invasive plants in the southeastern New England region are multiflora rose, Japanese barberry, and Oriental bittersweet. Between the 2007 and 2012 FIA reports, 19% of regional monitoring plots noted an increase in occurrence: multiflora rose and Oriental bittersweet each increased by 8%, and Japanese barberry, 5%.



Presence of the six most common invasive plant species found on invasive monitoring plots, Southern New England, 2007-2009
Source: [Rhode Island's Forest Resources, 2010](#)

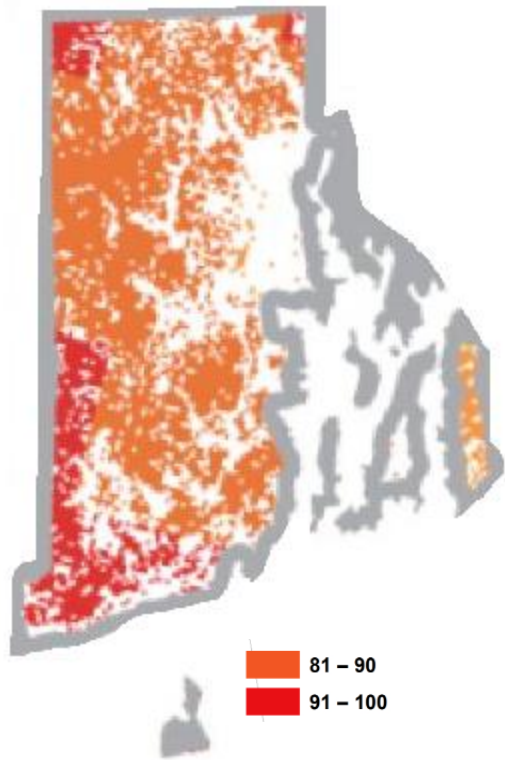
WILDLIFE HABITAT

Healthy forests are not solely determined by tree or stand health. As previously mentioned from the [RI WAP](#), the state's varied soil, vegetation, and hydrology support plant communities that support a wide range of wildlife, many of which utilize forest habitat for at least some portion of their life cycle. Whether generalists or specialists, the largest forested tracts, or core forests, support the greatest biodiversity of species throughout the forested landscape. Even with increasing fragmentation, retaining green corridors connecting these core sites can play a crucial role for the sustainability of wildlife populations.

The lack of age class diversity also affects wildlife, particularly those species dependent on early successional habitat, such as the New England Cottontail. The RI WAP estimates less than 4% of forest land is in the early successional stage (the RI WAP included shrubland in that calculation, in addition to young stands 0-20 years). Natural disturbances, like severe storms, do not create early successional habitat on a regular basis to support SGCN wildlife species, like New England Cottontail. Birds associated with early successional communities, including grasslands, scrub-shrub habitats, and young forests, have also declined. Several bird species, including: northern bobwhite, American woodcock, prairie warbler, and field sparrow, are listed in the 2019 [Partners in Flight](#) (PIF) assessment as being on the Continental watch-list for concern or decline due to a lack of early successional habitat. In contrast, according to the [Guidelines for Managing Wood Thrush and Scarlet Tanager Habitat in the Northeast and Mid-Atlantic Regions](#), wood thrushes and scarlet tanagers do best in forested blocks of over 250 acres and "consistently reach their highest breeding densities in mature to old forests that are dominated by hardwoods and contain a mix of large and small trees."

Fragmentation is the main reason for habitat degradation, dividing large contiguous areas of forest into smaller patches, increasing edge habitat and reducing interior habitat. This loss of ecological integrity not only has a negative impact on certain species, but also subjects the core area to deeper penetration of predatory and/or parasitic species (e.g. blue jays, brown-headed cowbirds, cuckoos). Few areas in Rhode Island contain core habitats large enough to support the full complement of expected species and natural ecosystem processes, which is reflected in the decline of forest interior species. The increasing number of landowners and collective small parcel size makes management for species that require large tracts of forested habitat difficult. RIDEM has prioritized the acquisition of large tracts of forest land as well as parcels adjacent to existing State-owned Wildlife Management Areas to address this concern.

Landowners who actively manage their forest land can benefit wildlife by creating a range of forest types and age classes distributed across the landscape. A partnership of organizations including the Natural Resources Conservation Service (NRCS), RIDEM, RIFCO, and RI Tree Farm Committee provide financial and technical assistance to create and manage forest habitat for the needs of a variety of species, committed to increasing the abundance of young forests and early successional forests across the forested landscape in Rhode Island.



Probability of Occurrence (%) for Moderate or High Ungulate Browse Impacts on Forest Land, Midwest and Northeast, 2017.

Source: [Subcontinental-Scale Patterns of Large-Ungulate Herbivory and Synoptic Review of Restoration Management Implications for Midwestern and Northeastern Forests](#)

WHITE-TAILED DEER

One particular concern for overall forest health and future forest cover composition is herbivory. White-tailed deer (*Odocoileus virginianus*) are highly adaptive to fragmentation, thriving in the wildland-urban interface. The spreading of suburban landscapes and increasing fragmentation of forests combined with the long-ago extirpation of most natural predators and a decrease in hunting has caused an increase in white-tailed deer populations. In western Rhode Island, [deer densities](#) of 15-20 per square mile are common, although higher densities may occur in some areas where hunting access is limited. An overabundance of deer can have a negative impact on forest vegetation since an individual deer can browse between 5-9 pounds of food a day, including tender shoots, buds, twigs, and leaves of trees and shrubs.

A 2017 USFS study looking at [ungulates and forest management implications](#) noted that Rhode Island forests have a high probability of forestland with moderate or high deer browse impacts. The study indicated that forest type most subject to high deer browse was oak-hickory of which 61% of Rhode Island forest is composed. Deer browsing preferences have been studied for many years and is [well-documented](#). An increase in tree species unpalatable or of low-preference to deer would have a significant impact on forest composition and habitat characteristics.

Addressing the impact of browse on regeneration may require silvicultural practices that are not commonly used in Rhode Island, as forest management typically practices clearcutting and rely on natural regeneration. In addition, evidence indicates that there are other factors which may be as significant in species composition, such as fire suppression and the resulting forest densification, as noted in the 2019 study, [Does white-tailed deer density affect tree stocking in forests of the Eastern United States?](#). Once again, reminding forest managers of the complexity of interactions, causes and effects, and the implications of decisions that play out to unexpected consequences over time.

A 2019 Landscape Scale Restoration grant was awarded for a multi-state, multi-partner effort (MA, RI and CT): *Increasing Resiliency in Southern New England Oak Forests*. This project will address deer browse while looking at the various aspects of forest health and managing for resilience. The project is discussed in the Multi-State Priorities further in this document.

Issue: Water

Water is of particular interest and concern in Rhode Island, whether large (or small) inland waterbodies, waterways and wetlands, or Narragansett Bay and salt marshes. Water quality and stormwater management affect all residents and habitats, human and wild. A [USFS 2009 analysis](#) of 540 large watersheds ranked several of Rhode Island's watersheds as having some of the greatest development pressure on private forests important for drinking water supply in the east: Blackstone, Pawtucket-Wood, Narragansett, and Quinebaug.

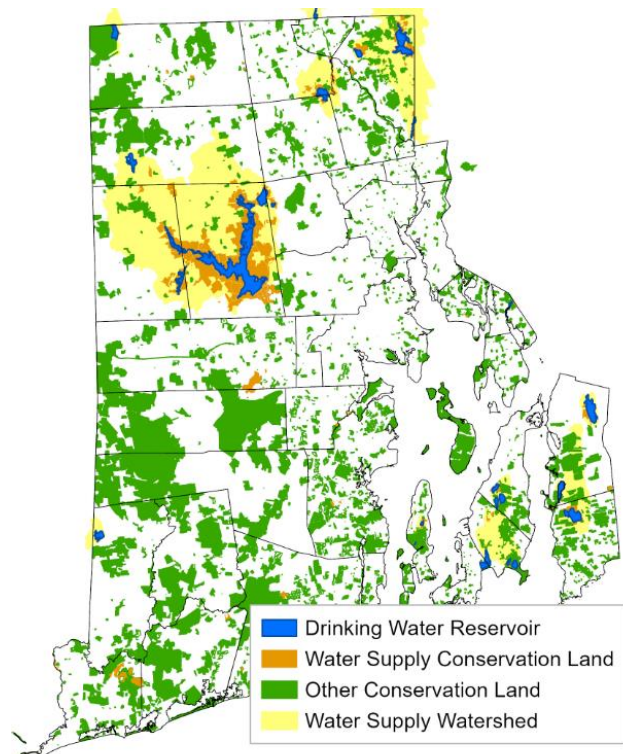
In addition to providing a safe drinking water supply, protecting clean water is critical to maintaining Rhode Island's aquatic ecosystems, fish and shellfish populations for safe consumption, and safe water recreation opportunities. The federal [Clean Water Act](#) requires states to create water quality standards and monitor and report on water quality conditions in the state. The RIDEM's [Office of Water Resources](#) (OWR) monitors and reports on:

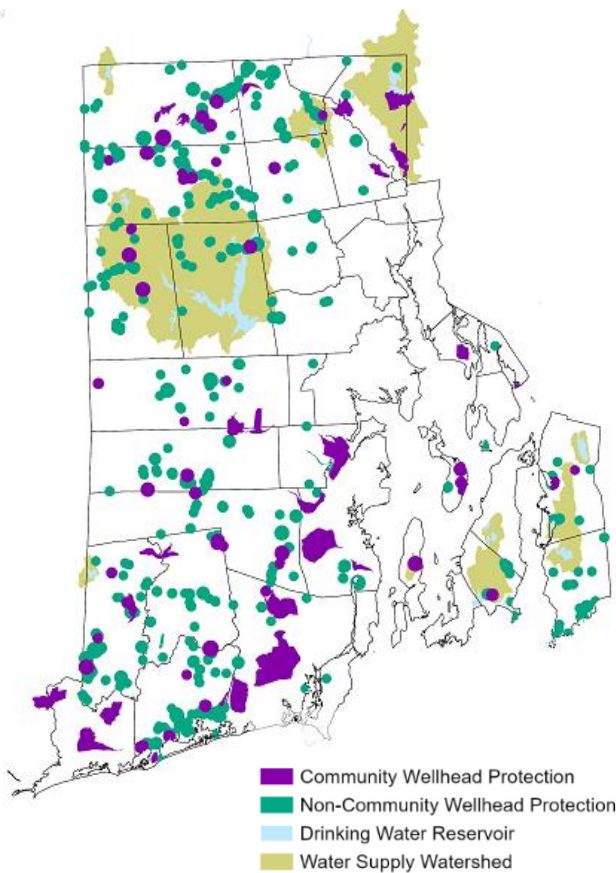
- 1,420 miles of rivers
- 20,749 acres of lakes and ponds
- More than 15,000 acres of freshwater swamps, marshes, bogs and fens
- 72,000 acres of forested wetlands, and
- 159 square miles of coastal waters like Narragansett Bay estuary and coastal ponds.

Rhode Island is home to some of the US's first public water systems. These systems were expanded in size and scope of their operations as the populations in the area they served grew – this is no longer feasible due to increased private land development. Other large public water suppliers now rely on the Providence Water Supply Board (PWSB) as a water source due to contamination from intensive land use activities. Although it was never intended to be the single source supply for the state, the [Scituate Reservoir of the Providence Water Supply Board](#) (PWSB) water system now provides water to the metropolitan areas of the State (600,000 persons or about 60% of State's residents) either directly or through other utilities purchasing water from the PWSB.

The Scituate Reservoir watershed's drainage area is about 60,000 acres. The PWSB controls 28% of the watershed (including 12,000 acres of managed forestland), the rest is privately owned. The watershed is subject to development pressure due to its proximity to Providence. The PWSB works to acquire critical parcels of land within the watershed to ensure important watershed resources are protected. Since less than a third of the land in the watershed is protected, stewardship of the remaining land by private landowners is identified as critical by the Forest Legacy Program. In 2019, the state received a grant through the Forest Legacy Program to focus on easements on the Scituate Reservoir Watershed. The grant application identified 716 acres on 14 targeted properties.

The Scituate Reservoir was never designed to be serve as the main source of supply for over 50% of Rhode Island's residents, but there is no large-scale alternative since the EPA prohibited construction of the Big River Reservoir in 1989. Initial efforts to





develop an alternative water supply by constructing a reservoir was determined by the EPA to likely cause serious environmental damage. The Big River Reservoir land (about 8,000 acres) was designated as open space by the Rhode Island Legislature. This land is protected and cannot be sold or developed except for the development of wells and well sites for the distribution of drinking water.

According to the EPA's [Safe Drinking Water Information System](#) (SDWIS), as of 2017 more than 80% of the 1.06 million people living in Rhode Island rely on surface reservoirs for clean drinking water. With few exceptions, the rest of the population relies on groundwater. Most of the State's groundwater is considered suitable for drinking water use. Four groundwater aquifer systems of the State have been classified as [Sole Source Aquifers](#) by the EPA, since they serve as the principal source of drinking water for an area and no other water supplies are available. About 26% of the state's population depend on other public water sources for their water supply and there is a total of [490 public water supply systems](#) ranging in size from small rural restaurants to 28 major suppliers.

WATER QUALITY

Forests act as a water filter as surface and subsurface water flow moves over and through soil into wetlands, creeks, and ponds, rather than across asphalt and concrete where the water picks up oils and pollutants before flowing into Rhode Island's waterways. This does not only affect those waterways: a 2002 study by the *Trust for Public Land* and the [American Water Works Association](#) found that for every 10% increase in forest cover in the source watershed, treatment and chemical costs decreased by about 20%. Similarly, a study of the [High Rock Lake watershed](#) in North Carolina showed water treatment costs trending lower in watersheds at least 70% covered in forest. A 2014 article in the [Journal of the American Water Works Association](#) discusses how protecting and sustainably managing forested watersheds makes economic sense as a strategy for water that complements traditional infrastructures by reducing costs and, in some cases, even opening new funding streams.

Currently, OWR has enough data to assess water quality in 65% of the river miles, 77% of the lake acres and nearly 100% of the estuarine waters. OWR's 2018 [Impaired Waters Report](#) identified 96 named water bodies as "impaired". For example, multiple junctures of the Blackstone River where it flows through Pawtucket, Central Falls, Woonsocket, North Smithfield, Cumberland, and Lincoln have been designated "impaired" due to the presence of lead, mercury in fish tissue, and fecal coliform (among other pollutants), rendering it unsafe for drinking, fishing, wildlife habitat, and recreation.

Forests play a monumental role in both water quality and stormwater management, filtering and protecting the water supply, and all other waters, for all residents in Rhode Island. Forest fragmentation and loss to development and other land uses is a major contributor to water availability and quality concerns. The impact of water quality and availability on wildlife habitat and species diversity, whether salt or fresh water,

is a significant management issue discussed throughout the [RI WAP](#). Whether the concern is a physical loss of pools, streams, wetlands, or a degradation of the quality of those waters, the impacts on wildlife and plants is of importance to maintaining a healthy and resilient landscape.

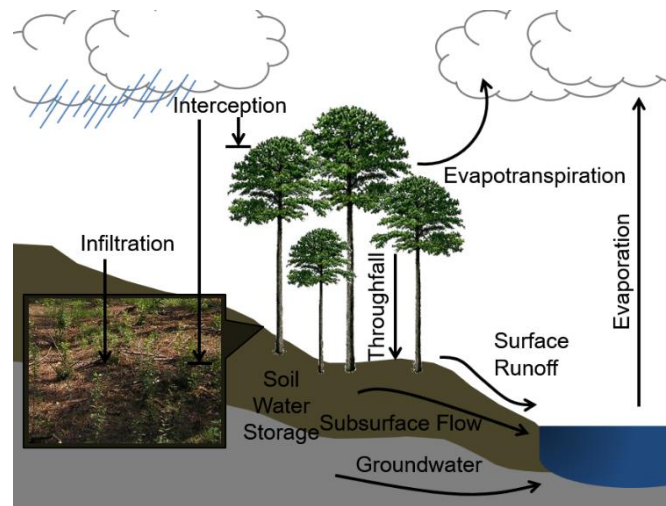
STORMWATER

Forests and other natural and well-managed working lands also play a significant role in stormwater management, slowing the rate of water flow into waterways and into built stormwater management infrastructure by intercepting rainfall, reducing rainfall intensity, and increasing storage capacity of soil.

Trees and vegetation slow and redirect waterflow through multiple mechanisms, reducing peak flows by:

- Interception by the crown, branches and trunk reduces amount of precipitation reaching the ground
- Throughfall is slowed so it impacts the ground with less speed and more opportunity to infiltrate
- Pervious soils allow infiltration and subsurface flow into waterways

In fact, a one-acre parking lot releases 36 times more water than one acre of forest ([Changing Landscapes, USDA NA-TP-01-14 A3](#), page 6). According to the [USFS](#), 100 mature trees can intercept and filter over 100,000 gallons of rainfall per year in their crowns, reducing the need for expensive stormwater controls and

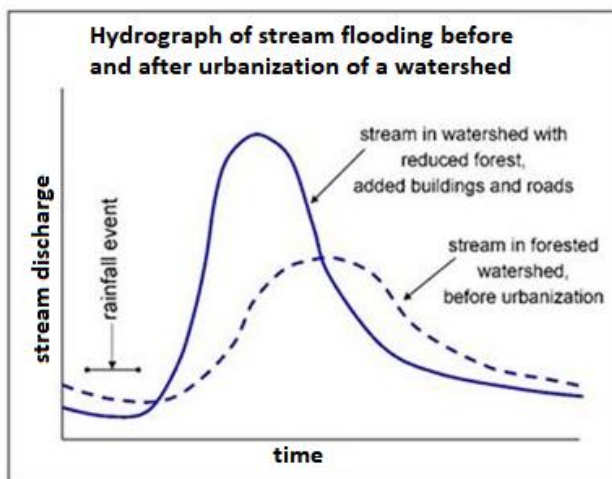


Precipitation Movement in the Landscape.

Source: [How Trees & Forests Really Affect Stormwater](#)

Simply by slowing the rate of flow, forests protect water. As we see changes in amounts and seasons of precipitation, forests mitigate those impacts. Increased volumes of water, either in single events or multiple events occurring within narrow timeframes, can result in:

- Increased flooding, making 50- and 100-year floods more common
- Increased velocity of water flow, eroding soils and streambanks
- Decreased water quality from surface flows carrying pollutants and high amounts of soil particles.



Source: [Lehman College](#)

As summarized [Oct 2016 in Stormwater](#) (Journal for Surface Water Quality Professionals):

- “Open-grown trees, as found predominantly in municipalities, generally have greater leaf area than comparable sized trees grown in forested stands. Because of this, municipal trees have been shown to retain greater rainfall volume than trees in forests.”
- “Coniferous trees (i.e., pine) tend to retain greater volumes than deciduous trees.”

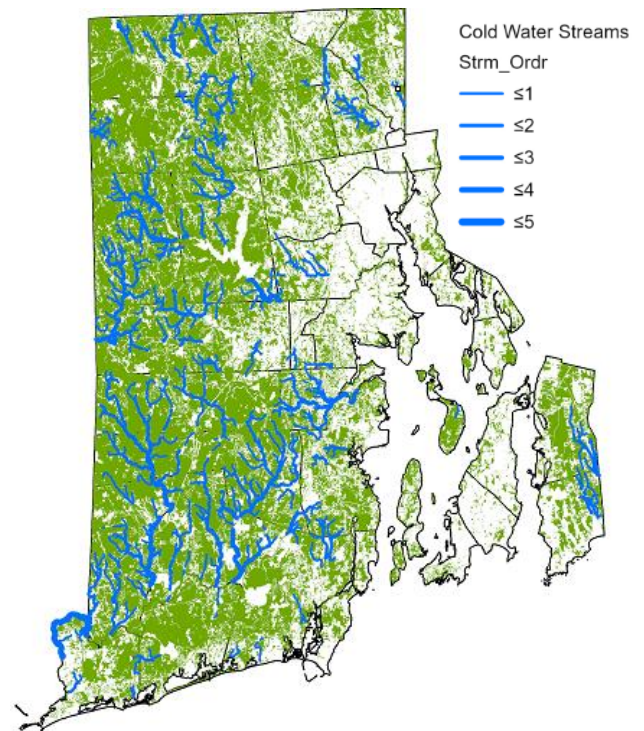
- “Urban trees have been shown to retain from 20% of the annual rainfall where rainfall volume and intensity can be great, such as in the southeastern United States, to as much as 80% in regions with relatively light rainfall intensity and volume, such as in the Pacific Northwest.”

WATERWAYS

The [RI WAP](#) identifies the conditions of, and threats to, waterways in Rhode Island and their value and use for wildlife. Waterways of all sizes and characteristics are necessary to provide the aquatic habitat needed for resilient and diverse populations of plants and animals. Besides the benefits that forests provide by filtering and slowing water entering these waterways, the forests also contribute other essential qualities.

- 1) Shade – the cooling effect provided by canopy cover along and over streams is very important to regulate water temperatures needed for habitat and life-cycle completion needs, as well as basic survival by maintaining oxygen levels. In Rhode Island, obligate cold-water stream species (like the native brook trout) are threatened by warming waters.
- 2) Food – leaves, flowers, seeds, droppings from tree canopies, and insects, can enrich the water and provide suitable nutrients for decomposers at the base of the food chain
- 3) Cover – branches, leaves and even the occasional limb or trunk contribute to a varied environment that can support a variety of organisms, insects, fish and other wildlife.

The majority of cold-water streams in Rhode Island are located in traditionally forested landscapes where obligate cold-water stream species, like native brook trout, are threatened by warming waters. Maintaining tracts of forest land protects the values and conditions needed to maintain living and vital waterways.



Distribution of Cold Water Streams Within the Protected Surroundings of Rhode Island Forests.

SOIL

While the impact of fragmentation on Rhode Island’s forests and habitats has been discussed previously, the source of that fragmentation has deeper implications for water quality, stormwater management, waterway health, and for forest health itself.

The replacement of these soils with impervious surfaces and the redirection of water movement, whether to built stormwater management or by changes due to grading, fill, or other reasons, affect the forests themselves, not just the waterways. Removal of topsoil, compaction of soil surfaces, changing the flow of surface and subsurface water flows also affect the forest functionality and benefits:

- Forest soils hold microorganisms, fungi, nutrients and moisture that is lost with their removal.
- Compaction of soils for infrastructure installations, and access to those structures, limits water infiltration, root penetration, and microorganisms.
- Grading changes can redirect water: reducing availability to trees adapted to historical water levels and/or increasing availability to trees in excess of what they are adapted to.
- Loss of soil carbon storage and decrease in site capacity to sequester soil carbon in the future.

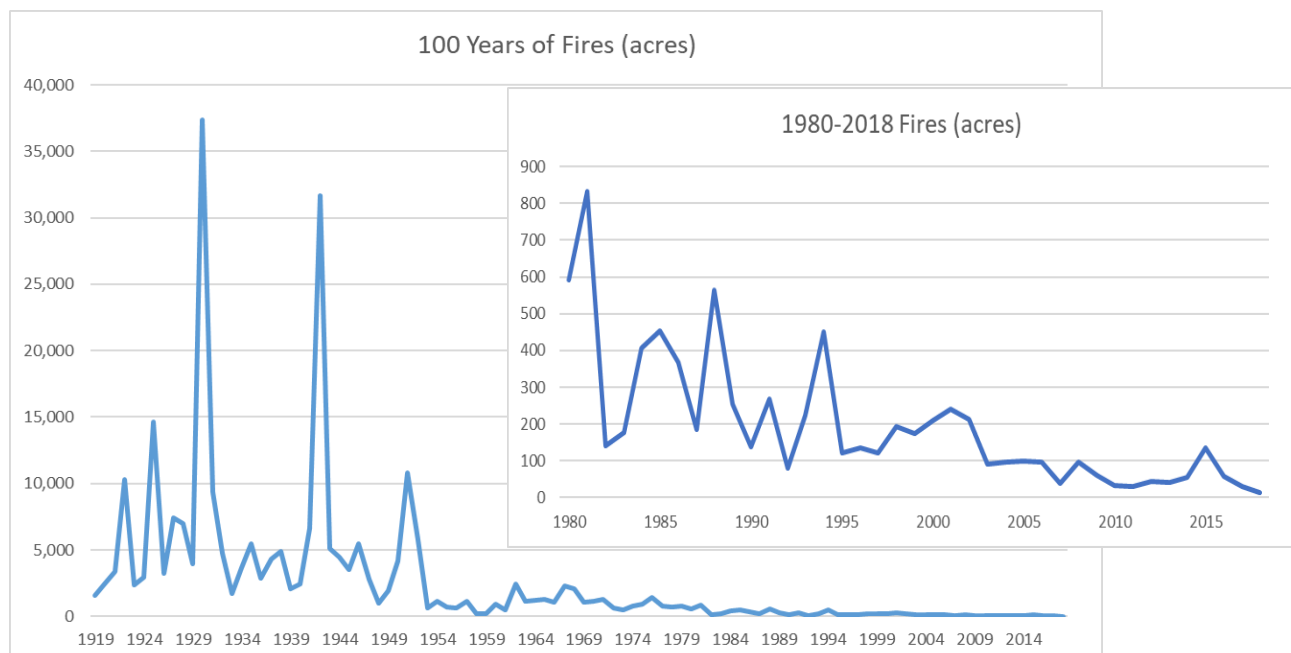
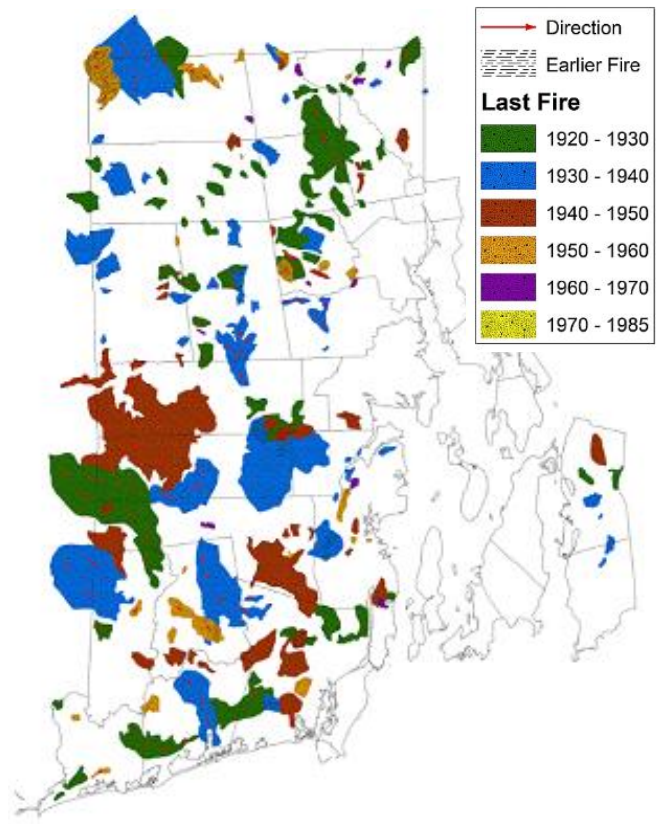
Issue: Fire

DFE's Forest Fire Program has existed since 1906 with the establishment of the Rhode Island Forest Commission, followed almost immediately by chestnut blight. During its 114 years, the Division of Forest Environment has seen various departmental names, and numerous large-scale event fires and large-scale disturbances leading to event fires or hazardous fuel conditions. The dynamic nature of the environment seems to be the constant.

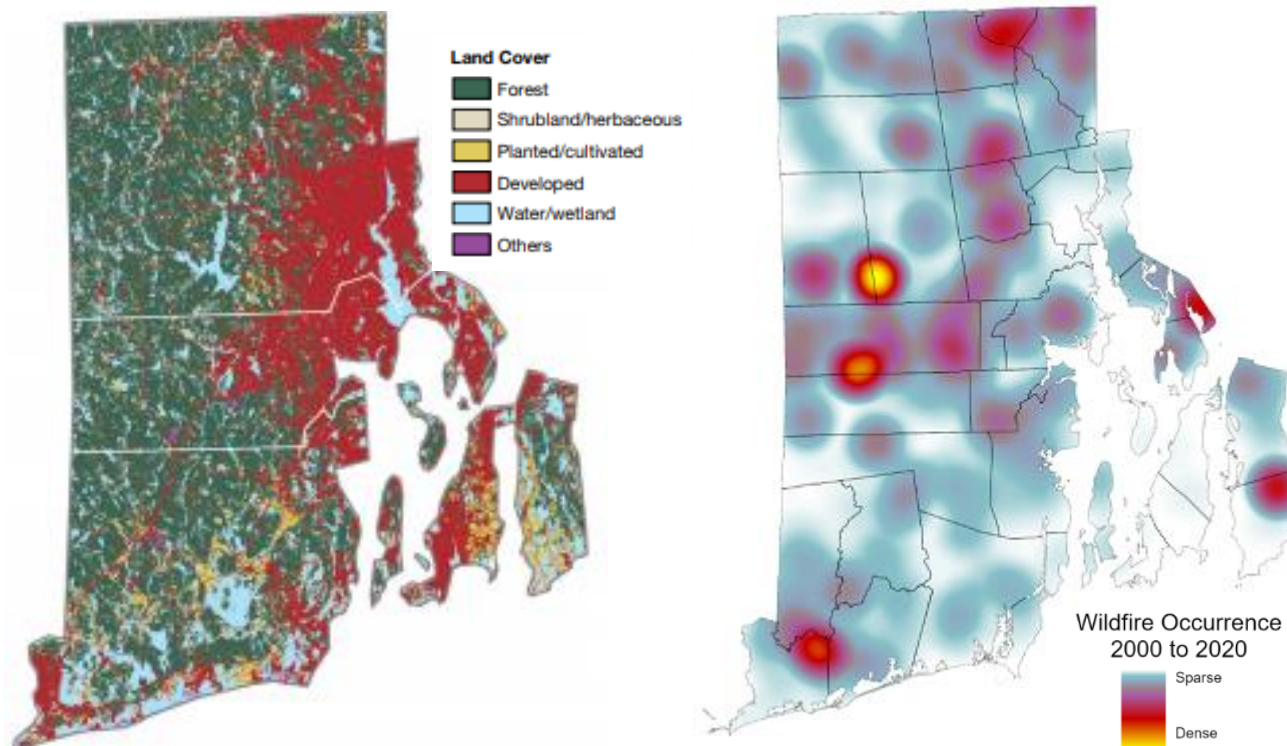
Rhode Island's fire occurrence from the 1920's to 1970 shows the size of fires in areas, many of which are still predominantly forest today, but now with more population and infrastructure than in the 20th century.

As the western part of the state has experienced an increase in development, the values at risk have increased significantly. However, this increase in wildfire risk is partnered with:

- decreases in resident awareness, concern, and preparedness for wildfire;
- communities and fire departments focused on increasing demands for EMS and HAZMAT services; and
- decreases in DFE staffing capacity for wildfire response, mitigation, and preparedness.



The expansion of the wildland-urban intermix/interface, with the associated increase in monetary, infrastructure and human values, combined with an unmanaged accumulation of dry fuels, and a lack of local and state preparedness and capacity, is of concern to DFE.



Source: [ESRI Green Infrastructure Strategy](#)

Fire location occurrence 2000 - 2020

Data from 2000 - present shows hot spots where human-caused fires commonly occur. When considered with respect to fire-adapted ecosystem information, historical fire occurrence, and population centers, escaped fires have the potential for rapid spread and impact to values at risk.

COMPOUNDING FACTORS

More recently, changes in seasonal weather patterns and precipitation have decreased moisture availability in the summer months, increasing tree mortality. Severe pest and disease mortality have also increased. All these factors combined have led to increased fuel loading and drier fuels across the state.



Oak mortality, due to gypsy moth defoliation, 2017.

After 3 years of intensive defoliation by gypsy moth, and droughty summers, many oak trees failed to recover, resulting in an estimated 45-50,000 acres of forest loss. Mortality in 2019 was attributed to the lingering effects of the chronic stress and other factors, such as continued drought during the growing season and other pests.

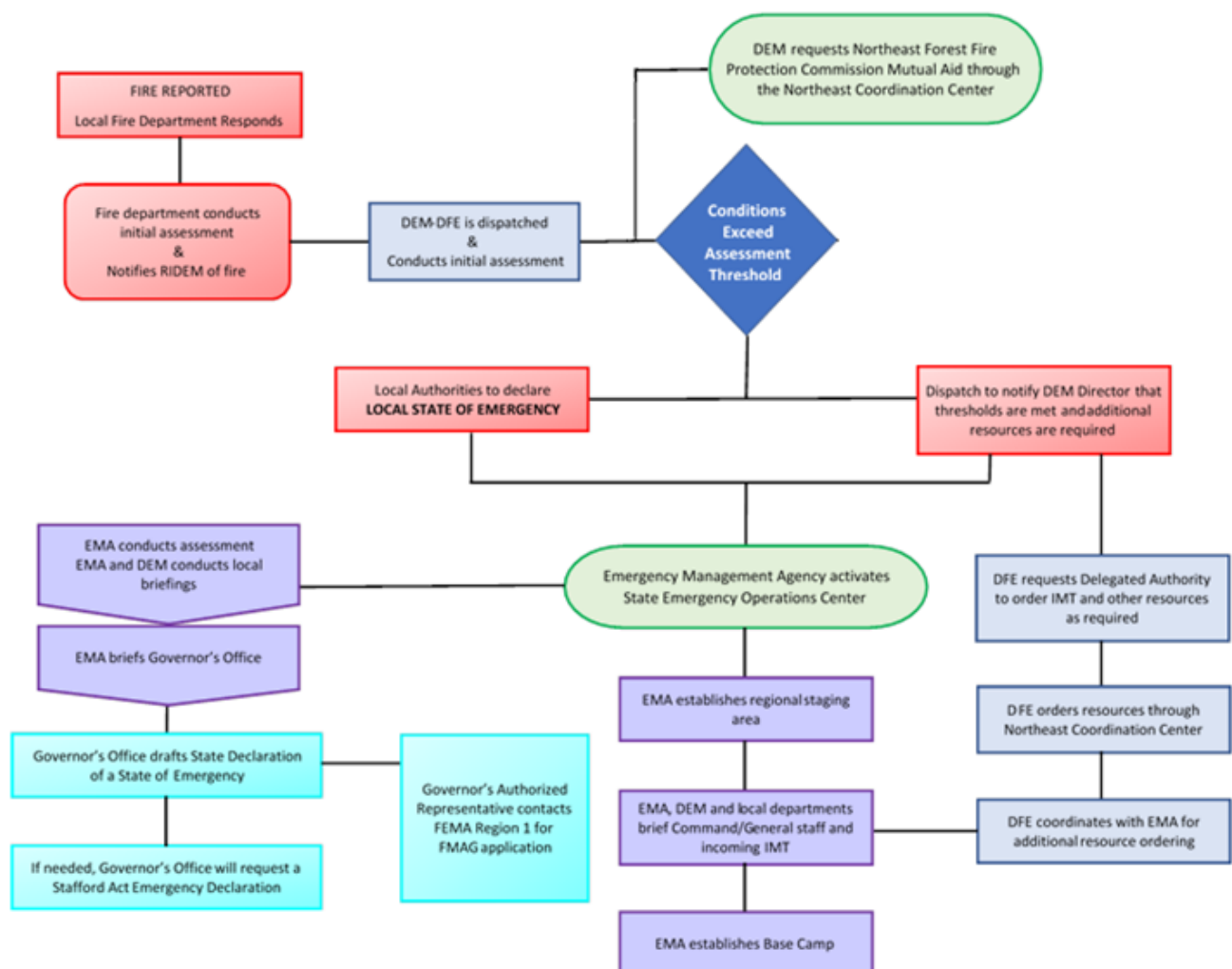
An increase in the population of two-lined chestnut borer (*Agrilus bilineatus*) developed as oak trees were increasingly stressed by gypsy moth defoliation. This borer contributed to late-season oak mortality in 2018 and is expected to be a significant contributing factor to oak mortality in the future, until the population levels naturally subside. Additionally, ash species mortality is anticipated over the next several years as emerald ash borer spreads through the state.

FOREST FIRE PROGRAM STATUS

Although prevention and enforcement efforts have been successful in reducing the incidence and size of fires in recent years, DFE has been unable to sustain response capacity and leadership to support local wildfire suppression efforts, primarily due to past substantial funding cuts. As the development continues to expand into rural and forested western Rhode Island, fuels continue to build due to declining management and forest health issues as weather and precipitation patterns become more extreme. This combination of elements indicates the potential for significant wildfire events in the future.



Over the past 20 years DFE has seen a shift in responsibilities and staffing levels, from 80 staff handling forestry, recreation (3 campgrounds, 4 beaches), law enforcement responsibilities, maintenance, etc., to an 80% reduction to 15 employees (of which 11 are field staff), with significant carry-over of non-forestry/fire responsibilities. With respect to fire suppression, presently there are 5 allocated Fire staff (Fire Science Officer vacant since early 2018) resulting in an extremely limited response capacity as a suppression force. This, combined with a lack of surge capacity/emergency firefighters, means that once local fire department capacity is exceeded, so too is state capacity, thus requiring external assistance. As a result, small scale incidents with a higher complexity due to urban interface would require a declaration of a state of emergency and mobilization of resources.



The pending state legal review of the [Stafford Act](#) further compounds the lack of suppression capacity. This has resulted in a cap on operational qualifications DFE that can be developed and utilize. The 2020 Fire Plan seeks to address these shortfalls by providing detailed information and guidance on the policies and procedures associated with fire suppression and an emergency declaration. Further effort is required to develop in-state capacity to limit the potential for small incidents to require a declaration in order to meet response objectives.

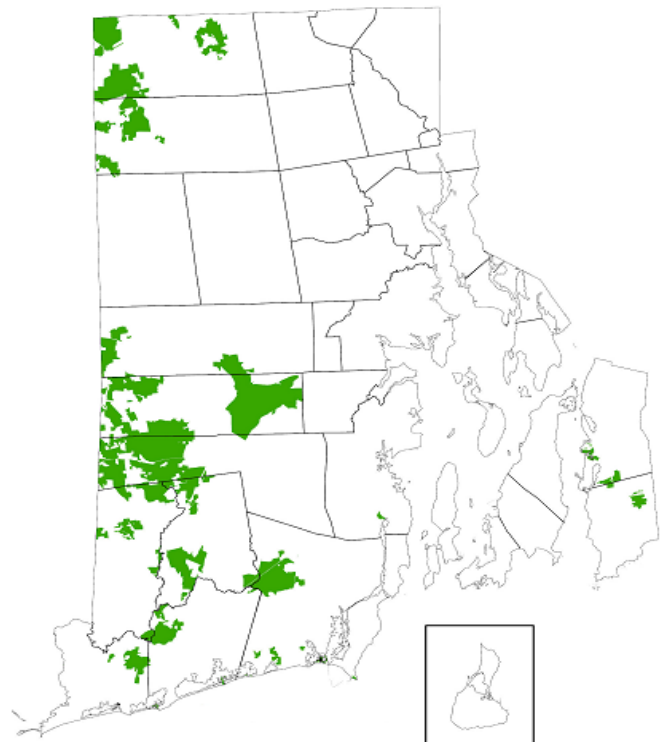
In addition to a lack of staff capacity, and a lack of agency level and public awareness, there is a lack of equipment and technology to allow the Forest Fire Program to communicate and deliver fire information, awareness and management:

- *Fire danger prediction* using a standardized prediction system, [National Fire Danger Rating System](#) (NFDRS), requires weather station measurements for: wind speed and direction, air temperature and relative humidity, precipitation, barometric pressure, and solar radiation. The Forest Fire program cannot meet the NFDRS standards with the current weather stations which, while comparatively new, lack the ability to integrate data with the [GOES16 satellite system](#), and do not collect solar radiation data. *Presently, Rhode Island's danger rating is calculated manually using 1967 indices which do not correlate well to more recent iterations, and will be completely obsolete when a new, updated danger rating system is released in 2020.* Due to the differences between the 1967 FDRS and the 2016 NFDRS indices, DFE is unable to communicate effectively to federal partners the actual fire danger.
- *Fire risk assessment* based on fuels, flame heights, and terrain at a scale appropriate to Rhode Island, requires data and mapping capabilities beyond existing budget and capacity.
 - Scale: 30m resolution results in many of Rhode Island's wildland-urban interface communities being labeled as developed land and, thus, classified as non-burnable and are reported as such in the federal budget allocation. However, these areas contain the same highly flammable fuels with a significantly high concentration of values at risk.
 - Ease of use: data is not easily available to municipalities, land managers, and fire departments, requiring a high degree of experience with, and access to, ESRI software.

Multiple efforts to access competitive federal funding have not been successful to date, that would allow DFE to develop the maps and strategies to effectively engage with local governments, residents and fire departments.

FOREST FIRE PROGRAM EFFORTS

- The Forest Fire Program has been working to develop program delivery through its 2020 State Fire Plan and increased engagement with [RIEMA](#) to increase awareness of fire risk and incorporate fire into hazard response planning.
- A WRR grant in 2019, Increasing Fire Awareness & Management in Rhode Island, is focused on utilizing [Firewise](#)® messaging to educate and empower communities, homeowners, and fire departments to understand and mitigate wildfire hazards by modifying their landscaping and land use to be fire adaptive.



RI DEM Management Areas

- The general goal is to institute a culture of preparedness and establishing defined actions at the time of an emergency (e.g. clearing brush around buildings, orderly evacuation, etc.)
- A specific target is to provide communities assistance with risk assessment, plan development, and implementation.
- Continued engagement with the Division of Fish and Wildlife to assist with prescribed burns for wildlife habitat and management; assistance with federal Fish & Wildlife prescribed burns; and to increase [Incident Management Team](#) (IMT) qualifications within DFE and other state agencies.
- A Wildfire Risk Reduction (WRR) grant in 2015 funded Rhode Island's first [Community Wildfire Protection Plan](#) (CWPP) for [Prudence Island](#).
 - Prudence Island has 88 year-round residents and is 3,565 acres, of which 85% is protected from development, and addressed within the plan. Further prescribed burning is planned for the spring of 2020.
 - Future efforts will be made to procure funding for development of CWPPs for Management Areas. The WUI intermix/interface would be served by such plans, and they would provide an example to Rhode Island communities.

Issue: Climate Change

As discussed within the Benefits section (page 18), forests simultaneously provide a myriad of benefits to the natural and built habitats of creatures and humans. The complex interactions within, and by, the forest is still barely understood but has withstood millennia of disruption and change; so what has changed? Fragmentation and parcelization, invasive plant and insect species, loss of biodiversity, interference with migration, overuse and overgrazing, more extreme weather events more frequently – all contribute to a forest that has less biological resilience and less time to respond and adapt. Given enough time, forests and the species that rely on and support forests can adapt to climate change. However, the effects of humans busily modifying their landscape is a factor that forests have not adapted to.

Increasing temperatures and rising sea levels are impacting Rhode Island, with temperatures projected to continue to increase with the associated impacts on forest type and growth. Changes in amounts and seasonality of precipitation, stream flow and pond levels, growing degree days, and temperature range are only a few of the processes impacted by changes in climate patterns. Retaining large, unbroken tracts of healthy forested land, as a contributing factor to the storage and reduction of carbon, is a valuable and quantifiable benefit.

[Climate Change and Adaptation: New England and Northern New York Forests](#) presents a useful summary of anticipated impacts and the significance of continued warming on northeastern forests. The climate-related impacts and their significance discussed include:

CLIMATIC IMPACTS

Warmer temperatures
Longer growing seasons
Shorter, warmer winters
Rising sea levels
Changing precipitation
More extreme precipitation
Changes to the water cycle

FOREST IMPACTS

More Variable Soil Moisture
Increased Risk of Drought
Stress from Forest Pests and Diseases
Competition from Invasive Plants
Changes in Suitable Habitat
Changes in Tree Establishment
Changes in Tree Growth
Changes in Forest Composition

These complex interactions are beyond the individual, or even the state, to manage. However, DFE **can** work to educate landowners and professionals of recommended actions, the main one being to encourage the planting of a variety of forest tree species that will be suited to the changing climate patterns. This will assist the migration of such species, avoiding fragmentation and development interruptions and speeding up the very slow movement of trees beyond their existing ranges.

The main challenge in Rhode Island is two-fold:

- 1) tree planting post-harvest is not commonly practiced, as regeneration is typically left to understory release and natural regeneration; and
- 2) the impacts on planted growing stock from overbrowsing by deer would be as severe and more expensive than presently occurring on natural regeneration.

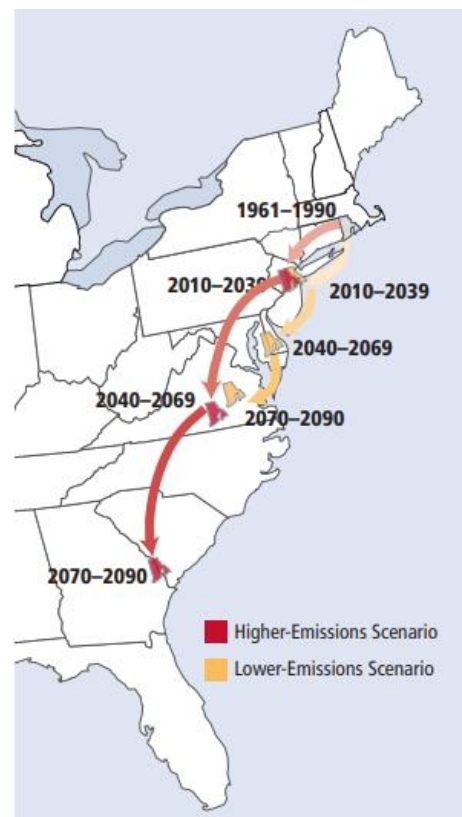
These are two significant challenges that do not have a quick solution, and will require working with stakeholders and partners, as well as identifying possible funding sources to develop and support a programmatic effort.

Predictive models for anticipated climate change look at the effects of various emission rate scenarios. An example on the right, from the [2006 Northeast Climate Impacts Assessment](#), shows the effects of two emission scenarios on the heat indices for Rhode Island over the next 80 years and what summers could feel like. While these changes are speculative estimates, and modeling and the rate of change had advanced considerably since 2006, this indicates the potential to result in significant changes to habitat and species composition.

The expected outcome of increased temperatures is that the growing range for individual trees, shrubs and plants will shift northward. This means that many species growing at their more southerly extent will be unable to withstand the changes in growing conditions and will become less common or disappear entirely in Rhode Island. This also means that species growing at their more northerly extent will find growing conditions conducive to expanding their range northward. The natural shift in growing range and dispersal is a slow process and, in the 21st century, is complicated by grey infrastructure, permanent land conversion, and other impacts of fragmentation. It seems that assisted migration will be needed to help ensure suitable species are present for the future growing conditions.

Local adaptation to other growing factors also needs to be considered, and much of that is unknown at this time – for example, red spruce growing at its most southerly range and elevation is also adapted to longer growing days. Simply planting a red spruce seed source in a more northerly location may not be as successful. To that extent, using seed sources within a defined range for localized adaption has been a guiding factor for some time – but the rapid change in expected growing conditions makes anticipating future conditions much more complicated. How habitats will be affected, and wildlife presence shift or disappear (locally extinct) is also of concern.

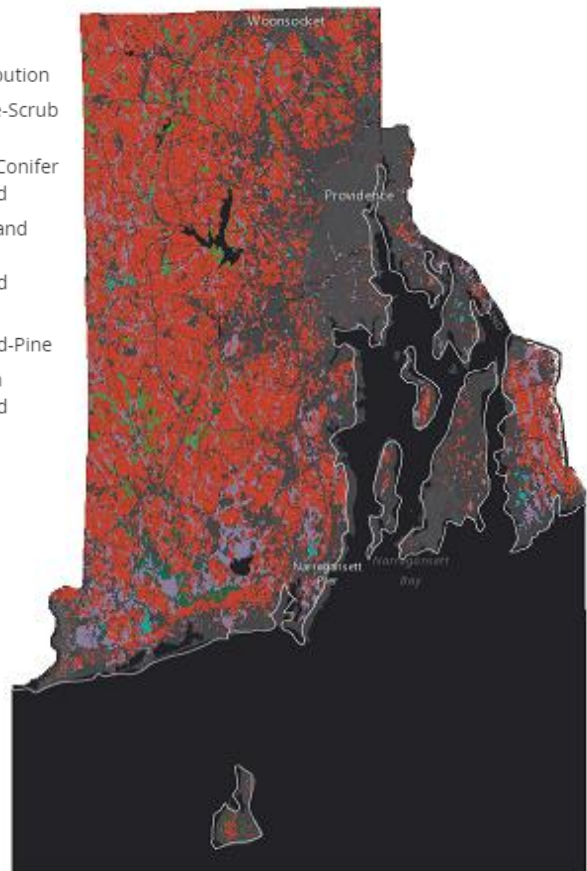
Consideration also must be given to the impact of climate change on forest types, not simply individual species. Species existing at their more southerly range and forest types comprised of such northerly species are considered to be considered to be more vulnerable to climate changes.



Forest Systems

Modeled Distribution

- Pitch Pine-Scrub Oak
- Lowland Conifer and Mixed
- Lowland and Riparian Hardwood
- Central Hardwood-Pine
- Transition Hardwood



Distribution of Forest Types in Rhode Island.

Source: [Climate Change and Adaptation](#)

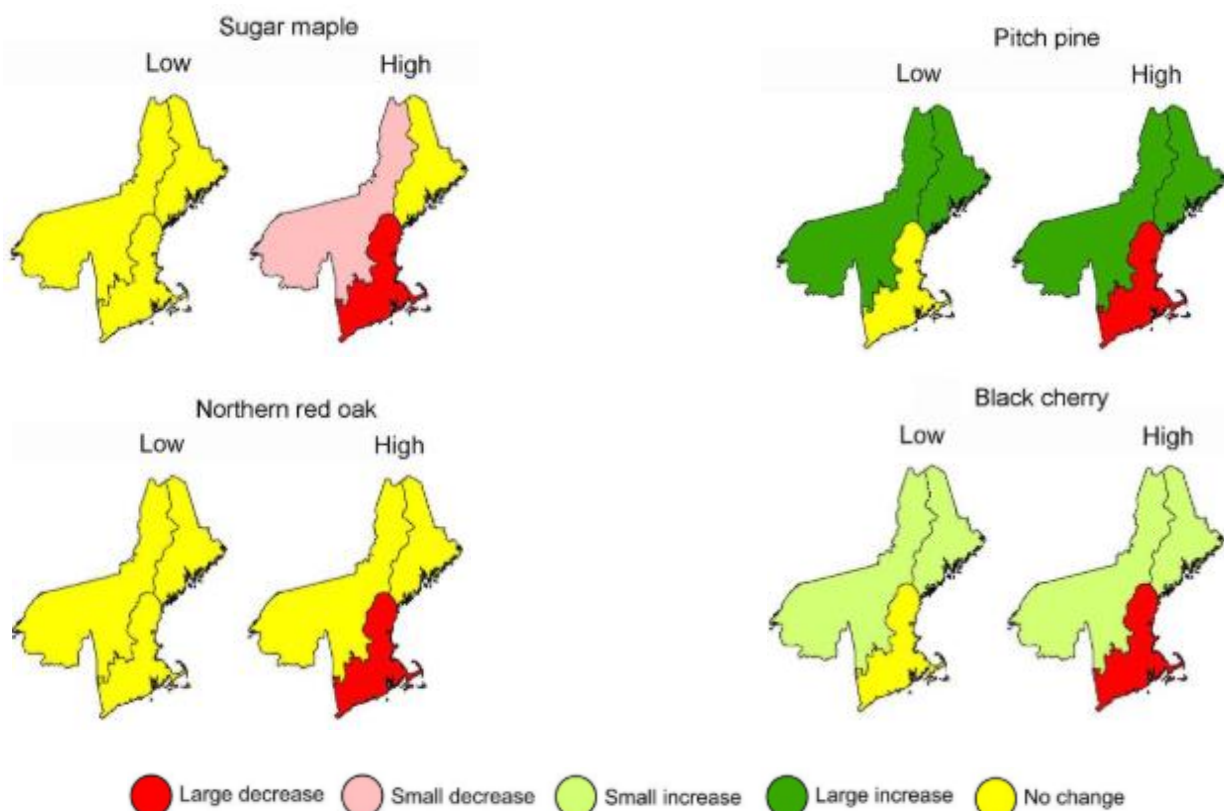
The [Climate Change and Adaptation](#) website also presents an assessment of vulnerability, shown in the following table. The assessment includes the level of evidence and degree of confidence in the vulnerability of forest types (which is not summarized here) and provides context for the ratings.

Forest System	Vulnerability
Pitch Pine – Scrub Oak	low
Lowland Conifer & Mixed	moderate-high
Lowland & Riparian Hardwood	moderate
Central Hdwd - Pine	low
Transition Hardwood	low-moderate

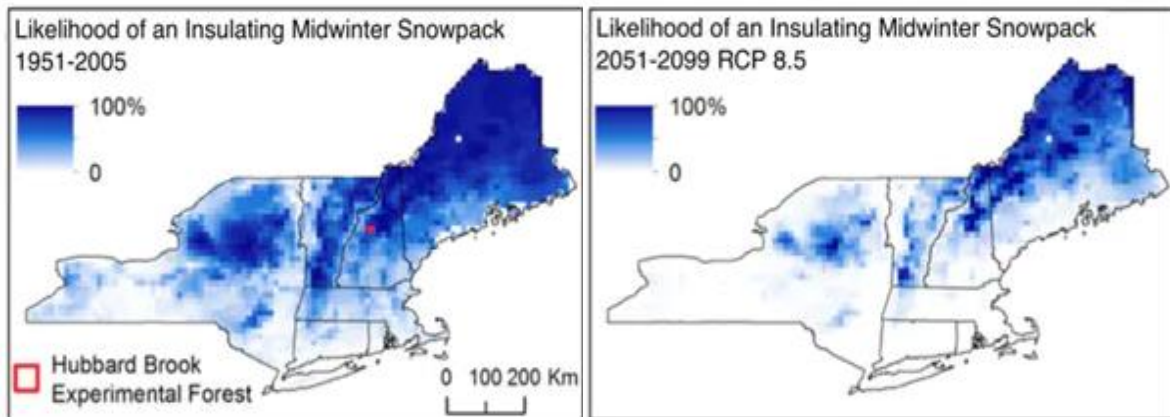
The [New England and Northern New York Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the New England Climate Change Response Framework Project](#), and the basis for the Climate Change and Adaptation website, identifies expected changes in the Northeast by 2100 to include:

- potential increase in mean annual temperature of 3 to 8°F;
- increase in fall and winter precipitation (spring and summer projections vary by scenario)
- projections suggest that many northern and boreal species, including balsam fir, red and black spruce, may fare worse under future conditions, but other species may benefit from projected changes in climate.

The possible impacts on some individual species are also considered under high and low emissions scenarios. This assessment and synthesis is more recent and the [modelling predictions](#) may not directly compare or correlate to the [2006 Northeast Climate Impacts Assessment](#) noted above, but continue to indicate changes to local growing conditions and establishment success, for example:



While climate change is often discussed and understood in terms of temperatures, changes in precipitation patterns and amounts will also come into play. Research also indicates that a decline in snow pack will have a [detrimental effect on northern forest growth](#) – even where temperatures may be suitable.



Source: [Climate Change is Shrinking Winter Snowpack](#)

Invasive plants, and exotic and native pests, will no longer have to withstand or recover from winter conditions and may be better able to establish and/or overrun habitats. The complexity of ecosystems makes accurate predictions challenging, not only longer growing seasons, but also desynchronized pollinators and food sources, bird nesting, and migration, etc., may have unforeseen impacts. The balance and structure of an ecosystem is resilient in the face of non-catastrophic change and fragile in the face of rapid change.

The issue of climate change does not have a significant impact on the planning or management actions within DFE. However, it compounds existing agency challenges by interfering with historical natural processes. Add to this political or legislative responses to climate change, whether at the local and national level, where response and effort may either enhance or degrade the functioning landscape.

DFE's role in the midst of this is education and technical support to encourage the retention and management of forest lands, as ever. It is necessary for DFE to advocate and support adaptive forest management practices that maintain a resilient forest able to withstand the effects of stress related to changing climate zones and pests and diseases (whether native or exotic). Communicating research and information for changes to management methods and resources requires adaptiveness and leadership. DFE will also need to explore funding and partnerships to initiate efforts that will benefit Rhode Island, based on good science, such as planting and protection of seedlings, assisted migration, demonstration sites, and financial assistance.

PRIORITY LANDSCAPE AREAS IN RHODE ISLAND

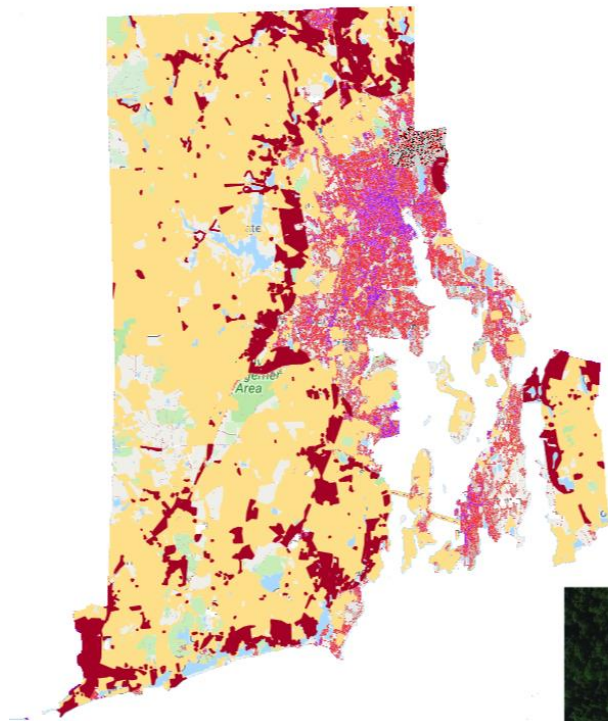
The determination of Rhode Island's priority areas for the Stewardship, Forest Health, Fire, and Urban Forestry programs is relatively straightforward in such a compact state. The priority areas for these four cooperative programs is where expansion of urban areas and ingress into forested areas is occurring: the wildland-urban interface and intermix – with each program focused on their audience and providing cross-messaging with the other programs.

[Stewardship](#) – landowners in the interface – managing their forests, and keeping their property as working lands; engaging and educating rural municipalities remains a significant challenge

[Forest Health](#) – introduced and invasive pests/diseases/plants – the interface is often where they appear and are more easily spread via human transport and developed corridors; educating professionals and homeowners to promote awareness and initiate management practices

[Fire](#) – wildfire risk – most fires are ignited by humans in the WUI – new outreach to municipalities with the Firewise message and assisting communities to develop plans and implement them for wildfire risk reduction

[Urban & Community Forestry](#) – expansion of urban areas and the loss of interior greenspace – an important part of the urban message is maintaining and planning for green space to limit the impact of landscape change.



This map, derived from the [i-Tree Landscape Tool](#), shows the Wildland-Urban Interface (WUI) in red and Wildland - Urban intermix in yellow.



[Wildland-Urban Interface](#) refers to a distinct area of wildland fuel adjacent to a developed area.



[Wildland-Urban Intermix](#) refers to a specific type of wildland-urban interface in which the homes or other structures are intermixed with wildland fuels, scattered or in small groupings.



Intermix

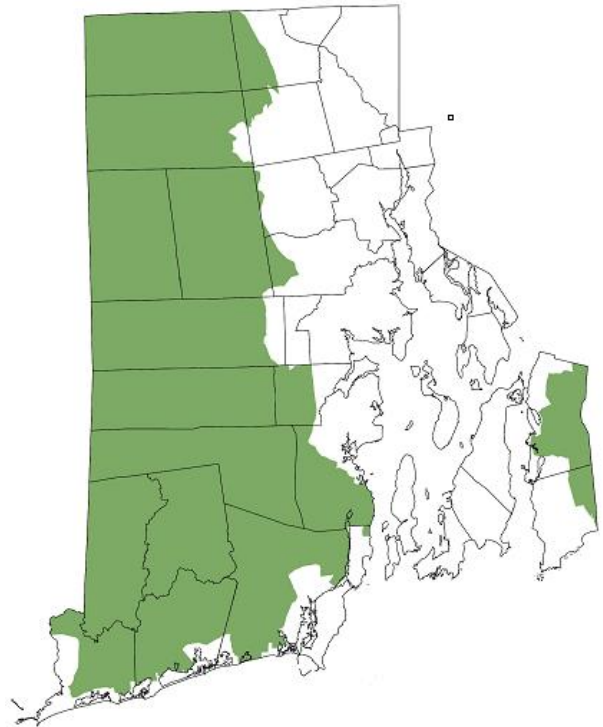


Interface

Source: [Researchgate.net](#)

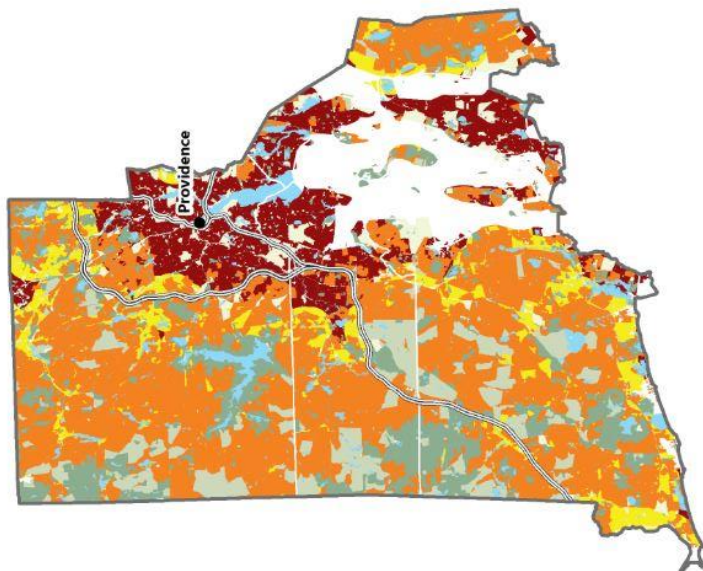
The [Forest Legacy Program](#) identified its priority areas in its 1993 document (see [Appendix G](#)). The Rhode Island Forest Legacy Program considers its priority areas as significant forest tracts, watersheds for public drinking water, public open-space tracts and recreational areas, location of rare, threatened and endangered species and/or their habitats, and significant mineral resources. The Forest Legacy Program also considers population growth statistics and communities identified as experiencing significant population increases. There are two distinct priority areas:

- 1) Mainland – comprised of the forested and intermix areas on the west side of the state, and
- 2) East Bay – where some of the last forested tracts remain in eastern Rhode Island.

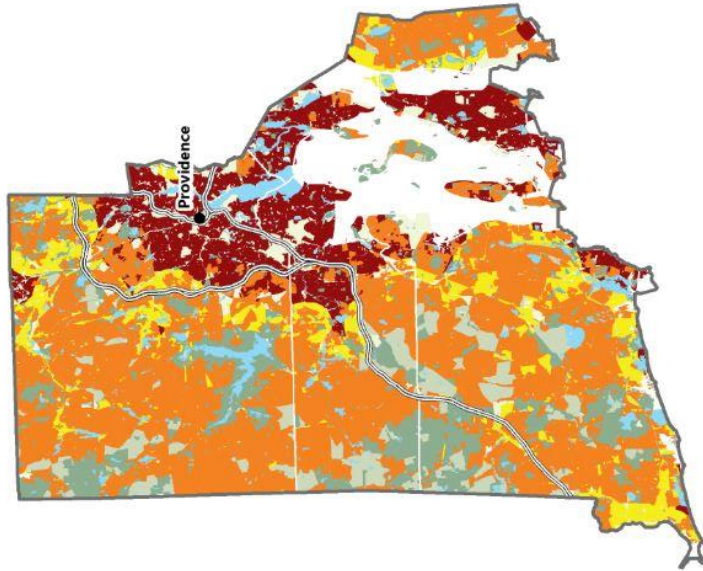


Forest Legacy Priority Areas.

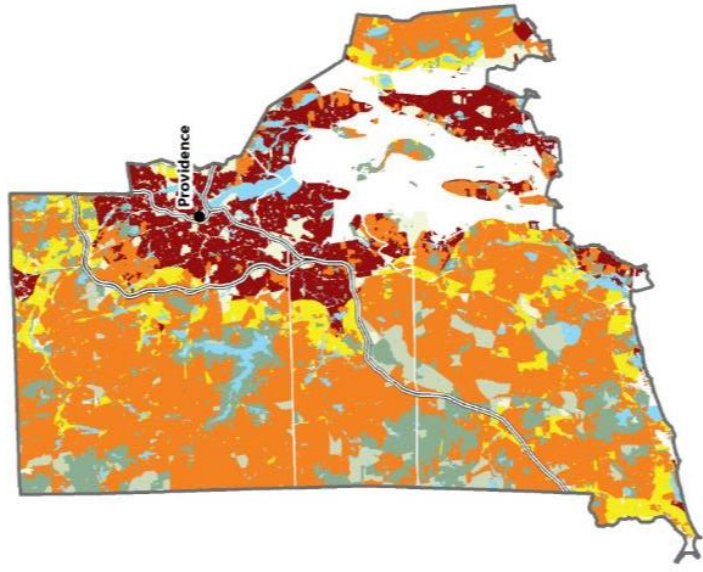
The basis for the four other cooperative program priority areas can be further described using data from [Silvis Labs, University of Wisconsin-Madison](#). The maps below show Wildland-Urban Interface (WUI) Change from 1990-2010. It is clear, even with the relatively coarse resolution, that while increasing interface (yellow) has been occurring in the more urbanized and highly populated areas of the state, the decrease of yellow in areas with no housing or very low housing (greens) is a result of conversion to intermix (orange). Besides protected, conserved, and state lands, Rhode Island has little land remaining that is unaffected by, or at risk from, human habitation or infrastructure in Rhode Island; there are few landowners, communities, and other stakeholders who are outside the priority target audience. Similar to the priority areas determined in 1993 for the Forest Legacy program, the forested areas of the state and their owners, comprising over 50% of Rhode Island, are significant.



1990



2000



2010

DATA SOURCES

United States Census Bureau
2010 TIGER blocks
Multi-Resolution Land Characteristics Consortium
2011 National Land Cover Dataset (NLCD)
Conservation Biology Institute
Protected Areas Database (PAD) version 2



Source: [Silvis Labs](https://silvis.labs.wisc.edu/), [University of Wisconsin-Madison](https://www.wisconsin-madison.edu/)

MULTI-STATE PRIORITIES

Rhode Island contributes to several multistate or joint efforts that involve RIDEM-DFE or its partners, whether federal, regional, or local. Some of these efforts are programmatic in nature, related to the cooperative forestry programs where shared efforts and grant proposals occur:

- [Northeastern Forest Fire Protection Compact](#)
- Eastern White Pine Multi-state LSR grant FFY2016
- [Urban Forest Inventory Analysis](#)

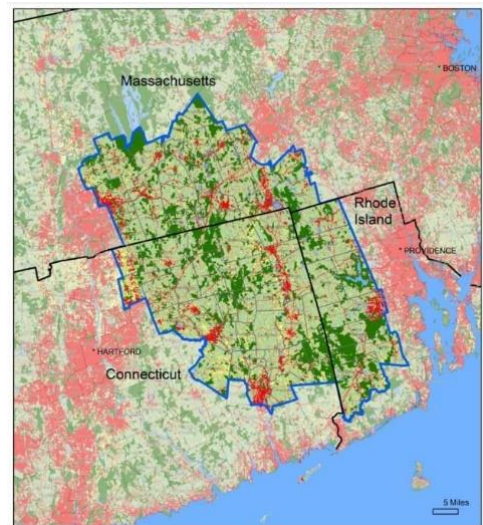
Other multi-state efforts involve multi-tasking stakeholders and partners who ably represent Rhode Island and ensure its regional representation and contribution:

THE SOUTHERN NEW ENGLAND HERITAGE FOREST REGIONAL CONSERVATION PARTNERSHIP PROGRAM (RCPP)

This Program is a partnership between the [Natural Resources Conservation Service](#), [The Last Green Valley](#), [MassConn Sustainable Forest Partnership](#), and the [Northern Rhode Island Conservation District \(NRICD\)](#). The program's target area includes the Southern New England Heritage Forest (SNEHF) a 11.4 million-acre corridor where 76% still remains in forest. An analysis by Harvard Forest shows that by 2030, as much as 20-40% of this forest will be lost or fragmented to development.

SNEHF's over-arching goal is to keep forests as forests, maintaining as much unfragmented, core forest as possible; a goal that supports both federal and state concerns.

Goals include: improve forest habitat for fish, wildlife, & invertebrate species of concern; support the recovery of endangered or threatened species and improve biodiversity; protect water quality and quantity; foster forest resiliency and stand diversity; and enhance air quality and carbon sequestration.



Source: [The Southern New England Heritage Forest](#)

Funded through the NRCS [Regional Conservation Partnership Program](#) (NRICD) the program has funding for five years for work within Rhode Island:

- Identifying easement opportunities in perpetuity (13 applications, resulting in 3 projects), with restoration plans that incorporate threatened and endangered interior bird species.
- Incorporating Audubon bird surveys and habitat plans into forest management plans within the SNEHF, either new plans or incorporating the bird plans into existing plans.
- Implementing forest management plans (3rd phase of project not yet active).

INCREASING RESILIENCY IN SOUTHERN NEW ENGLAND OAK FORESTS

This program is a multi-state [Landscape Scale Restoration](#) grant awarded by the USFS to the [Forest Stewards Guild](#) in 2019. The [RI Woodland Partnership](#) (RIWP) was instrumental in developing the project and connecting with partners in neighboring states (MA and CT). Through education and outreach the project aims to:

- Increase forest stewardship activities that increase oak resilience;
- Empower natural resource professionals with tools for assessing oak forest health;
- Increase landowner awareness of regeneration challenges and solutions; and

- Foster communication between states and agencies about strategies for addressing oak forest resilience and regeneration challenges.

Besides the Forest Stewards Guild (FSG), partners include:

- CT Agricultural Experiment Station (CAES)
- CT Forest & Park Association (CFPA)
- University of Connecticut Cooperative Extension Service (UConn)
- CT Dep't of Energy & Environmental Protection (CT DEEP)
- MassConn Sustainable Forest Partnership
- MA Dep't of Conservation and Recreation Bureau of Forestry and Forest Fire Control Service Forestry Program (MA Forestry)
- MA Dep't of Conservation and Recreation Division of Water Supply Protection (Quabbin)
- RI Dep't of Environmental Management Division of Forest Environment (RIDEM DFE) and Division of Fish and Wildlife (RIDEM DFW)
- Providence Water Supply Board (Providence Water)
- RI Woodland Partnership (RIWP)

FOREST ECOSYSTEM MONITORING COOPERATIVE (FEMC)

[FEMC](#) is a multi-state cooperative effort to gather and synthesize trends in forest ecosystem health across the Northeast. The USFS funded program is housed at the University of Vermont where it provides resources to states, and supports ongoing research, monitoring, outreach and data synthesis. Rhode Island has recently joined FEMC and is required to maintain a state partnership committee to identify FEMC priorities and state needs. [RIWP](#) acts as the State Partnership Committee for Rhode Island, with its broad representation across the state, and with DFE represented on the FEMC steering committee.



STAKEHOLDER ENGAGEMENT

Stakeholder engagement in the development of this action plan included public input, partner review and stakeholder committees.

- Public input was solicited through a survey on the [DEM Facebook](#) page in 2019.
- Preliminary reviews of the Assessment and Strategies sections by cooperative program partners: URI, DFW, RIWP, RITC, occurred in 2019 and 2020.
- Meetings with stakeholder committees in early 2020, including State Technical Committee, Stewardship Committee, Fire Advisory Committee, DFW and RIWP. In many cases, people representing different groups were on multiple committees, and all partner groups were given the opportunity to provide input and feedback into the draft.

Public Input Summary

An electronic survey, adapted from the New Hampshire SFAP survey, requested input from the public and stakeholder groups made available for 6 weeks in summer of 2019. The survey was created on the www.wvufoo.com website and shared directly with groups and posted multiple times on DEM's [Facebook](#) page. DEM utilized Twitter and sent out a press release towards the end of the time frame to garner further participation. The survey can be found in [Appendix E](#) with a summary of responses.

Responses exceeded expectations with a response rate of 0.13% from an estimated 2019 state population of 1.06 million. 67% (863) of the respondents expressed one or more written concerns, ranging from tree removal for ground-mounted solar installations to climate change, water, deer browse, and garbage in state parks, in nearly 2,000 comments, whether a single word or a lengthy statement.

The comments could be organized into several main themes corresponding to DFE priority issues:

- Fragmentation
- Water Quality
- Forest Health (including deer and wildlife)
- Fire
- Climate Change

In addition, other themes of concern included:

- Private Land Management
- Actions, Policy & Legislation
- DEM & DFE Capacity & Funding
- Urban Forestry
- Education/Knowledge
- Solar
- Recreation

Many of these concerns are addressed within the DFE strategies and are part of the larger picture of holistic program delivery, where sufficient capacity exists. Other concerns expressed can only be acknowledged due to the existing DFE capacity, such as larger scale actions, policy and legislation, Department/Division funding, or solar issues. Some, like recreation, fall under the purview of multiple programs.

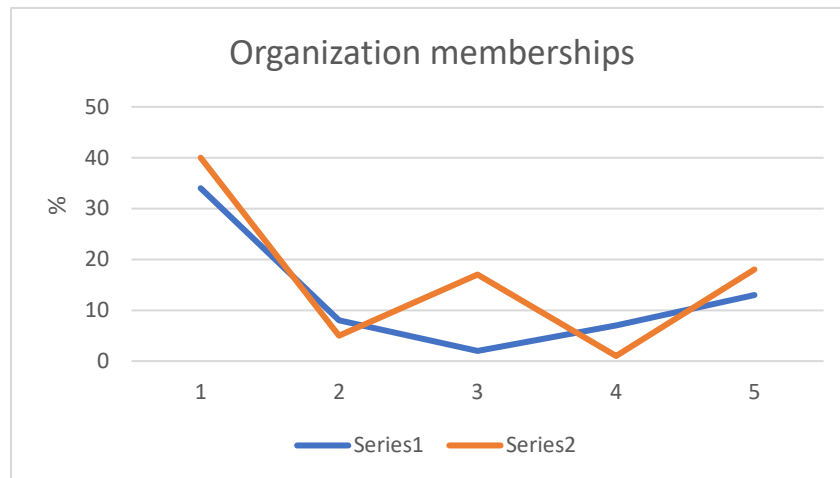
The following word cloud was created using the 100 most commonly occurring relevant words in the 1930 comments, after the most common words of forest(s) and tree(s) were removed.



Overall, responses between landowners and non-landowners were quite similar; however, there was no statistical analysis done on any of the results. Several identifying questions were asked, including land ownership and organizational memberships.

	Non-Landowners		Landowners	
# of Respondents	910	70%	383	30%
Club membership - 0	405	45%	178	46%
Club membership - 1	325	35%	124	32%
Club membership – 2 to 4	180	20%	84	22%

Level of club memberships were similar between the two groups, although the breakdown of the groups varied somewhat. The most common combination of multiple memberships for both groups was conservation, land trust, and recreation.

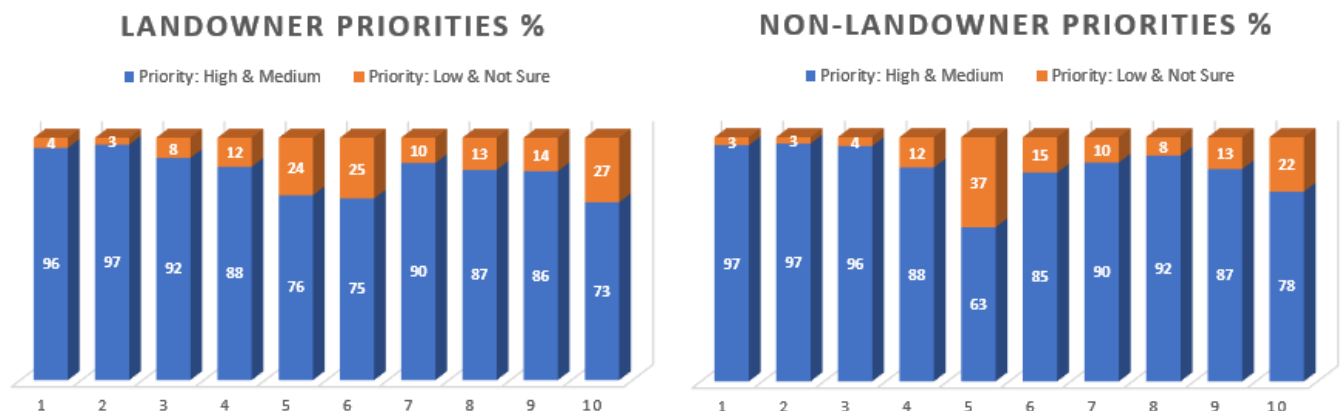


More non-landowners were members of land trusts. The other memberships were quite similar between the two groups, with even a few non-landowners being part of woodland owner groups.

The rest of the survey was comprised of 2 questions that required the respondents to prioritize the 10 listed challenges and 10 desired outcomes.

CHALLENGES TO ADDRESS IN RHODE ISLAND IN THE NEXT 10 YEARS:

1. Forest ecosystem health and biodiversity issues: e.g. invasive species, deer browse, species and age diversity, threatened and endangered species, natural disturbance, extreme weather.
2. Loss of forest land and increasing forest fragmentation.
3. Public values provided by forests: e.g. water, climate, carbon storage, forest products, recreation, education, culture.
4. Public land management challenges: e.g. staffing and funding for planning, maintenance, etc.
5. Challenges and opportunities facing private forest landowners.
6. Climate change.
7. Public awareness and support for funding for management of state forests and assistance to landowners and communities.
8. Funding for effective forest planning and policy (e.g. land use planning, use of open space lands, regulations).
9. Land use conversion pressures on public and private forests.
10. Urban forestry management capabilities in Rhode Island's communities.



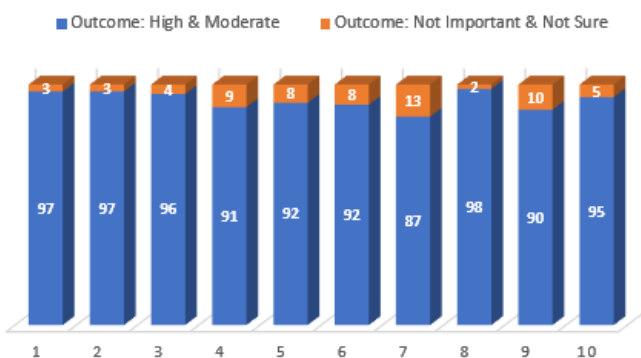
Forest health and diversity and fragmentation (# 1 and 2) were not only the two issues with the greatest support in both groups, but also garnered a substantial number of comments. People are concerned about where Rhode Island is headed and the lack of resources to address these issues.

The biggest difference between the two groups was that fewer non-landowners (63%) considered *challenges facing private landowners* (#5) to be a priority issue; although only 76% of landowners considered it a concern, which suggests a question to be explored. Non-landowners considered *climate change* (#6) to be more of a priority issue than did landowners (85% vs 75%). Overall, issues 5, 6 and 10 (*urban forestry capabilities*) garnered the most “low” or “not sure” votes. The differences in priorities between the two groups for the other priorities, were minimal. The results suggest that some demographically targeted messaging might be appropriate to increase understanding of the three lowest priority issues.

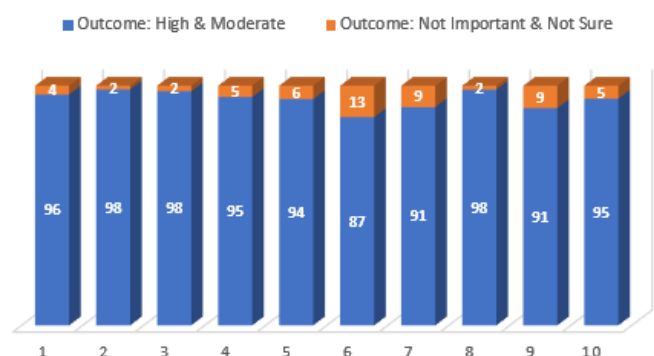
IMPORTANCE OF OUTCOMES TO THE FUTURE OF RHODE ISLAND’S FORESTS:

1. Businesses, public decision makers, the forestry community, and the public have the information they need to make informed decisions about the ecological integrity and sustainability of the resource.
2. Contiguous blocks of forest and working lands remain intact to provide environmental benefits and ecosystem services.
3. Landowners, resource professionals, and the public understand that forest lands contribute to the protection, availability, and sustainability of high quality, cost-effective drinking water.
4. Healthy and sustainable urban & community forests support livable, desirable, and ecologically healthy communities.
5. Residents and visitors support and understand the value of Rhode Island's forests: the benefits they receive from the forest and the relationship between a healthy environment and a healthy, vibrant forest-based and tourism economy.
6. Privately owned forest lands are supported to remain working lands for landowner, community, and state benefits.
7. Rhode Island forests contribute to mitigation of global climate change, managed for resiliency to climate change with minimal adverse environmental and economic impacts.
8. Rhode Island's forests are able to support healthy and sustainable populations of native plants and animals.
9. Residents and local fire departments are prepared for wildfires through planning, implementation, and response, reducing risks to people and structures; and protecting Rhode Island's forests and natural communities.
10. Rhode Island citizens and professionals are well prepared to respond to threats from invasive species; supporting adequate monitoring, response plans, and suppression programs to minimize the impact of invasive plants, insects, and diseases.

LANDOWNER IMPORTANCE %



NON-LANDOWNER IMPORTANCE %



The ratings for the outcomes were even more similar and consistent between the two groups than the priorities, with 7 of the 10 outcomes within 0-2%. The outcomes with the greatest support were *healthy and sustainable plants/animals* (#8) and *contiguous blocks of working lands* (#2). These were narrowly followed by *resources needed to make decisions* (#2) and *importance of forests to drinking water* (#3) pointing to the concerns of residents and the need for decisive action and implementation of planning standards.

The outcome with the greatest number of “not important” or “not sure” responses was *mitigating climate change* (#7), followed by *wildfire preparedness* (#9). Again, the results suggest that some targeted messaging might be appropriate to increase understanding of these issues. While large wildfires have not occurred with any severity for many years, smaller fires are frequent during the fire season and the possibility for larger wildfires has not decreased.

The intent of this survey was to narrow down or refine the priorities and concerns of residents, in order to identify the priority issues for DFE’s next 10 years. It is apparent that the agency and the residents are in sync in what they see as threats to their state, communities, and ways of life. Clearly, many Rhode Island residents are not unaware of the interconnectedness of many of the issues and see effective leadership and action, and even funding, as necessary to protect the natural inland environment.

Stakeholder Input

RIDEM-DFE solicited input and feedback from various partner individuals and committees. Program partners input on the information’s accuracy, clarity, and perspective prior to sharing with the larger committees, including the draft Assessment of Need for the Forest Legacy Program. The DFE U&CF contracted report, [The Value of RI Forests](#), which was written by the Rhode Island Forest Conservation Advisory Committee and [RITC](#) (also are members of the [RIWP](#)), provided significant information regarding Rhode Island-specific resources and practices, context and insight, and identified as contributing to this report.

Due to COVID-19 stakeholder meetings were convened virtually in April and May 2020. The Stewardship Committee, as part of the RIWP, provided feedback...

Rhode Island

2020 State Forest Action Plan: Strategies

The Cooperative Forestry Assistance Act (CFAA) of 1978 (Public Law 95-313), as amended through [Agricultural Act of 2014 \(P.L. 113-79\)](#), gives the United States Forest Service (USFS) the authority to provide financial and technical assistance to states, and others, on a variety of forestry issues. These issues include forest management and stewardship, fire protection, insect and disease control, reforestation and stand improvement, and urban forestry. As amended by the 2008 (and 2014) Farm Bill, the CFAA also requires each State forestry agency to maintain a “Statewide Assessment and Strategies for Forest Resources,” or State Forest Action Plan (SFAP), to be eligible to receive funds under the authorities of the Act.

The programs which comprise Cooperative Forestry for Rhode Island include:

- State Fire Assistance & Volunteer Fire Assistance (SFA & VFA)
- Forest Health Management (FHM)
- Forest Stewardship (FSP)
- Urban & Community Forestry (U&CF)
- Forest Legacy (FL) – see [Appendix G](#)

The Cooperative Forestry Programs promote the health and productivity of forests, emphasizing timber and other forest products, wildlife, water resources, rural economies, and conservation practices. The programs’ overall goal is to maintain and improve the environmental, economic, and social benefits provided by the state’s urban and rural forests.

These programs:

- Improve cost effectiveness by using partnerships to deliver programs
- Increase forest-related values by sustaining forest productivity
- Use voluntary, non-regulatory approaches.

The financial assistance provided to each state must be equally matched by that state and each individual program must meet their national eligibility requirements, including the statewide strategy (revised every 10 years). The strategy must include strategies for addressing threats to forest resources in the state, a description of the resources necessary for the State Forester to address the statewide strategy, and must address the three national State & Private Forestry (S&PF) priorities:

4. **Conserve** and Manage Working Forest Landscapes for Multiple Values and Uses
 - 1.1 Identify and conserve high priority forest ecosystems and landscapes
 - 1.2 Actively and sustainably manage forests
5. **Protect** Forests from Threats
 - 2.1 Restore fire-adapted lands and/or reduce risk of wildfire impacts
 - 2.2 Identify, manage, and reduce threats to forest and ecosystem health
6. **Enhance** Public Benefits from Trees and Forests
 - 3.1 Protect and enhance water quality and quantity
 - 3.2 Improve air quality and conserve energy
 - 3.3 Assist communities in planning for and reducing forest health risks
 - 3.4 Maintain and enhance the economic benefits and values of trees and forests
 - 3.5 Protect, conserve, and enhance wildlife and fish habitat
 - 3.6 Connect people to trees and forests, and engage them in environmental stewardship activities
 - 3.7 Manage trees and forests to mitigate and adapt to global climate change

The Cooperative Forestry Programs have identified their respective goals, objectives and strategies to successfully deliver programs that address the issues and priorities in Rhode Island, which also correlate to the [DEM Strategic Plan 2019-22](#) (see correlation matrix in [Appendix F](#)).

Additionally, the state land managed by DFE, while not a part of the Cooperative Forestry Programs, is an important partner in the conservation and management of forest land in Rhode Island, and provides recreation access and educational opportunities – which contributes to the achievement of some of the goals of the Cooperative Programs. As such, State Lands Management is included in the Strategies Section to fully communicate the extent and direction of RIDEM Division of Forest Environment.

State Priority Issues

Forest lands in the rural, urban, and interface/intermix are significant resources benefitting all residents. Suburban and urban “forests” are increasingly recognized (and researched) as contributors to the economic, ecological, aesthetic, and human health values associated with traditional forest land, and to the well-being and quality of life for those who live, work, and play there.

Rhode Island faces many of the same issues and concerns as almost all states, but at a smaller scale that reduces its resiliency and increases the impact and visibility of even comparatively small disturbances, land-use changes, or pest/disease infestations. Meanwhile, Rhode Island’s suburban sprawl continues to blur the boundary between forested and non-forested lands and creates opportunities for the introduction and spread of native, invasive, and naturalized insect pests, plants, and pathogens, potentially increasing risk to Rhode Island’s forest health. Not only do rural forest health issues overlap with urban and suburban issues, but insects and pathogens harmful to trees do not differentiate between the two, so actionable items in Rhode Island typically include and affect both communities.

The main threat to Rhode Island’s forests, whether rural, suburban, or interface/intermix, is disturbance. Throughout history, disturbance from one source or another has impacted forest land. However, the scale of that disturbance, its frequency, degree of degradation, and permanence, when placed in context of human population and demands, challenges the equilibrium of natural processes and environmental services.

The threats and issues and concerns discussed in the Assessment section of this document are all sources of disturbance, and are mainly driven by human activity or interference:

- Fragmentation
- Water
- Forest Health
- Fire
- Climate Change

Climate change further complicates and compounds these disturbance issues on an international scale by increasing pressures and stress on forest landscapes and individual trees and reducing resources and resiliency in those same landscapes. Regardless of what is driving observable and measurable changes to planet-wide climatic processes, the impacts of such change influence forest processes from the micro- to the macroscopic. These climate changes alter the equilibrium of our natural environment and its ability to recover, respond, or adapt to those changes. Humans may be the source of much of the pressures on forest lands, but they will also be one of the victims with the loss of large- and small-scale landscape functionality.

State Priority Landscapes

As discussed in the Assessment section (page 53), each cooperative program has its own goals and objectives, but the impacts of disturbance and land change are priority concerns. With Rhode Island’s small size, disturbance in any area, whether rural, urban, or in-between, has direct repercussions in the adjacent areas. *This means that the entirety of Rhode Island remains as the state priority area.*

Within Rhode Island, there are specific areas expected to face the most immediate disturbance pressures. Based on past development trends, those projected areas are in the Wildland-Urban Interface (WUI) adjacent to larger urban areas. While the entirety of the state is a priority, the WUI areas have been identified as specific areas of interest for all cooperative programs to deliver messages and technical support to **conserve, protect, and enhance** functional working lands in these urban-adjacent areas. Within the national priorities, the program's goals are to work within the state's priority areas to:

1. Conserve and Manage Working Forest Landscapes for Multiple Values and Uses

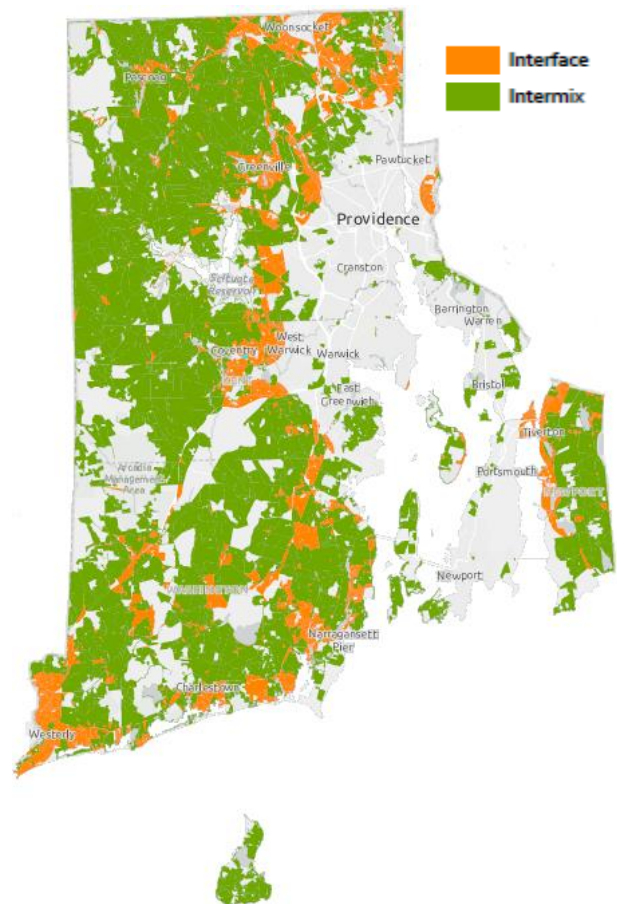
- SFA: Conserve forest resources and ecosystems by supporting resiliency-focused stewardship.
- FHM: Promote the conservation and management of Rhode Island's forests through practices that address forest health and resiliency.
- FSP: Increase NIPF certified under the Forest Stewardship Program through targeted outreach to landowners.
- U&CF: Promote active and sustainable management to conserve trees and forests where people live, work and play.

2. Protect Forests from Threats

- SFA: Protect communities and their ecosystems from negative impacts of wildfire.
- FHM: Protect Rhode Island's forests by monitoring and evaluating forest health conditions and threats.
- FSP: Protect private forest land from development and degradation.
- U&CF: Protect trees and forests from threats through planning and response (invasive, catastrophic, climate, etc.).

3. Enhance Public Benefits from Trees and Forests

- SFA: Enhance public benefits from trees and forests to Rhode Island communities and residents by developing increased resiliency to wildfire.
- FHM: Enhance public benefits from trees and forests through promotion of practices and programs that address threats to forest health.
- FSP: Enhance forest resources and ecosystem services of private forest lands.
- U&CF: Enhance the public benefits of trees and forests through improved management practices.



Priority Landscapes: Wildland-Urban Interface/Intermix.

Resources for Success

Accomplishing the goals identified in this SFAP requires three primary elements:

1. Continued federal funding for Cooperative Forestry Programs at current or increased levels.
2. Retention of professional staff committed to building internal capacity and delivering the best program possible within the limiting factors of stringent budget and staffing levels.
3. Positive and fruitful working relationships with Rhode Island forestry-focused non-profits.

Rhode Island receives the base USFS federal funding. Although DFE cannot be assured of future sustained federal support, the US Forest Service funding is crucial to the delivery of the DFE Cooperative Forestry Programs. The Program coordinators positions are contingent on that funding, which contributes to salary and programmatic travel needs.

While DFE has invested in acquiring dedicated and enthusiastic staff to deliver and advance state forestry programs, it struggles to work beyond the limitations of a minimal State budget (essentially supporting staff only). DFE staffing is minimal and staff experience an increasing workload and multitude of responsibilities. This results in DFE staff often lacking the time and the resources to fully engage and contribute to regional and landscape-scale efforts that address issues shared by multiple states.

DFE recognizes the challenges of retaining such staff with limited state and federal funding. Under ideal circumstances, sufficient resources would include increased funding to expand DFE staffing; increasing budget levels affected by years of reductions. The bare-bones budgets, lack of up-to-date resources, and the inability to access necessary resources (planning, mapping, assessment, etc.), keep the programs and the coordinators from accomplishing all that they are capable.

Additional funding would be directed towards:

- capacity building across the S&P programs
- increasing resources to expand education and outreach to all constituents, public and private
- improved data gathering tools and mechanisms

Programmatically, this could translate to:

- Forest Fire – develop wildfire risk maps based on scale suitable for RI; increase access to low/no cost training for VFAs
- Forest health – fund sufficient flights for health monitoring; increase access and tracking for new controls, particularly biological
- Stewardship – direct funding to assist landowners with costs associated with plans; develop and print materials; increase program education and access
- Urban & Community Forestry – increase subgrant program to provide sufficient support for management: inventory, planning and canopy assessments

Increased funding to better plan, manage, diagnose, and disseminate information on the health, condition, and risks to Rhode Island's forests is essential to increase public support and advocacy for forest protection and enhancement activities.

Partnerships and collaborations are crucial to protect, conserve, and enhance Rhode Island's forest cover. DFE works closely with several non-profit and other state and federal governmental agencies, participating as frequently as possible, to improve forest management and education. These partnerships are integral to Rhode Island's forest management and future conditions, and without these crucial relationships the reach and engagement of all levels of residents and landowners would be drastically reduced.

The collective resources provided by the US Forest Service, providing financial and technical expertise; a qualified and motivated staff; and multiple working partnerships are all key to the DFE's success now and in the future.

Goals & Objectives Matrix

Conserve and manage working forest landscapes for multiple values and uses.		
Objectives	S&PF Programs	Partners
Develop and expand existing planning and hazard monitoring capacity.	FIRE (SFA)	Federal & Regional Partners RIEMA
Increase capacity for implementation of management recommendations to achieve resiliency goals.	FIRE (SFA)	DEM RIEMA Fire Departments
Develop and deliver information on multiple platforms that addresses the identification and management of forest insect, disease, and non-native invasive threats.	FHM Fire (SFA) FSP U&CF	URI RI Division of Agriculture
Increase collaboration with local partners' management efforts to address forest health.	FHM FSP U&CF	URI RI Division of Agriculture
Increase NIPF certified under the Forest Stewardship Program through targeted outreach to landowners in cooperation with partner groups.	FSP	NRCS RIFCO RIWP private
Promote forest management and conservation within spatial communities of small landowners using a landscape-scale approach.	FSP Fire (SFA) FHM U&CF	NRCS RIFCO RIWP private
Maintain RI's active involvement in regional and national Cooperative Forest Management (CFM) committee.	FSP	
Increase the number of communities with active local urban and community forestry programs.	U&CF	RITC Local gov't
Improve technical and professional capacity of tree-care professionals and the green industry.	U&CF FHM	RITC Local gov't
Advance community urban tree inventory and planning capabilities	U&CF Fire (SFA) FHM	RITC Local gov't

Protect forests from threats.		
Objectives	S&PF Programs	Partners
Develop in-state wildfire response (surge) capacity and specialist skills.	FIRE (SFA)	DEM RIEMA Fire Departments
Improve communication between in-state partners and responders.	FIRE (SFA)	RIEMA Fire Departments
Maintain fire response capacity.	FIRE (SFA)	Federal & Regional Partners Fire Departments
Survey for native and non-native forest insect and disease threats and monitor for their outbreak and spread.	FHM	URI RI Division of Agriculture
Work with regional and national partners to disseminate current information about the biotic and abiotic threats to RI's forests.	FHM	URI RI Division of Agriculture
Maintain lines of contact and support structures for NIPF owners via onsite visits, meetings, informational exchange, and site inspections.	FSP	NRCS RIFCO RIWP private
Provide access to and information on relevant educational opportunities, current events, and funding opportunities.	FSP	NRCS RIFCO RIWP private
Promote forestry BMPs, and expand messaging, especially in regard to harvesting operations, which should be inspected prior to harvest and during operations to prevent wetland violations.	FSP	NRCS RIFCO RIWP private
Develop disaster preparedness and rapid response capacity.	U&CF	RITC Local government
Promote trees and urban forests as an energy-saving practice.	U&CF	RITC Local government
Facilitate awareness and proactive response to invasive pests and diseases affecting trees in urban and rural forests.	U&CF	RITC Local government

Enhance public benefits from trees and forests.		
Objectives	S&PF Programs	Partners
Increase public awareness of wildfire and the need for preparedness.	FIRE (SFA)	RIEMA Fire Departments Municipalities
Incorporate a Firewise approach to wildland urban interface areas.	FIRE (SFA)	RIEMA Fire Departments Municipalities
Expand stakeholder engagement in collecting forest health information and disseminating forest health messaging.	FHM	URI RI Division of Agriculture
Maximize messaging effectiveness by increased coordination with partners for responses regarding threats to RI's forests.	FHM	URI RI Division of Agriculture
Promote active, sustainable forest management supporting wildlife habitat diversity, structural diversity, and understory health to landowners.	FSP	NRCS RIFCO RIWP private
Promote good silvicultural practices to support forest health, ecosystem resiliency, wetland conservation, wildlife habitat, and carbon storage.	FSP	NRCS RIFCO RIWP private
Provide education and outreach on forest management for special areas, highlighting the relationships of private forest land to wetlands and water quality, air quality, climate protection, and urban-rural interface values.	FSP	NRCS RIFCO RIWP private
Incorporate green infrastructure into municipal planning.	U&CF	RITC Local government
Assist communities with tree planting goals and plans.	U&CF	RITC Local government
Support statewide, regional and local tree advocacy groups.	U&CF	RITC Local government

State Fire Assistance & Volunteer Fire Assistance (SFA & VFA) Programs

Program Description

The Rhode Island [Forest Fire Program](#) is comprised of two federally supported programs:

1. State Fire Assistance (SFA), CPG; and
2. Volunteer Fire Assistance (VFA), not CPG

Both support state and local rural fire prevention and control programs by providing financial support for prevention, control, suppression, and prescribed use of fires. This funding is also authorized to help conduct preparedness activities, including training, equipping, and otherwise enabling state and local firefighting agencies to respond to requests for fire suppression assistance and to uphold departments statutory responsibilities. These funds, distributed through the Division of Forest Environment (DFE), promote mobilization readiness for efficient suppression of wildfires on all state and private lands, which assists in maintaining resilient forests and promote working relationships and service excellence.

These federal funds are essential for DFE to address its critical fire management needs and to develop capabilities as described within the [National Cohesive Wildland Fire Management Strategy](#). The goals include restoring and maintaining resilient landscapes, fire adapted communities, and safe and effective wildfire response. Within its Forest Fire program, DFE is required to specifically address and report on expenditures and activities that contribute to achieving the goals related to:

- Preparedness
- Suppression and Support
- Equipment
- Training
- Community Mitigation and Hazardous Fuels

Strategic Partnerships

REGIONAL

While the Fire Program engages with its adjacent State counterparts, the main mode of engagement is through the [Northeastern Forest Fire Protection Compact](#) (NFFPC), of which Rhode Island is an active member. The multi-state, multi-provincial organization provides its member states and provinces with assistance to address fires that might be beyond the capabilities of a single member through information, technology, and resource sharing (mutual aid) activities. One of the primary services the NFFPC provides is facilitation for training and qualification development. The NFFPC makes it possible to access qualified individuals to deliver local training to better meet local and regional obligations. Involvement in NFFPC committees, planning, and meetings involves 100% of the Forest Fire Program staff (4 people) to fulfill the required state commitments.

LOCAL

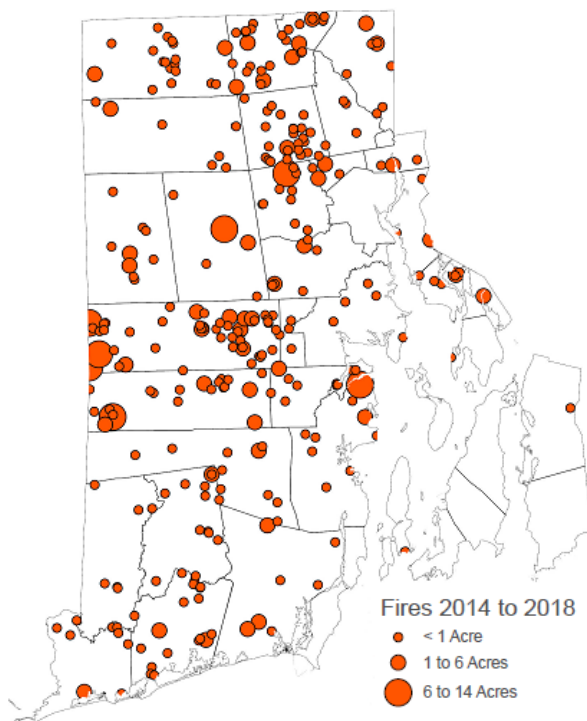
In Rhode Island, authority is delegated from the Director of DEM to the local fire departments to conduct wildfire suppression, prevention and mitigation work. The Forest Fire Program engages with the local fire departments and associations to identify and develop capacity to meet these goals. Partners include the [Rhode Island Fire Chiefs Association](#), [Rhode Island State Firemen's League](#), and the regional Fire Leagues: Northern Rhode Island, Central, Southern, and Woonasquatucket Valley Leagues. These partners are engaged in various activities such as training, hazard fuel reduction, prevention and outreach. The Forest Fire Advisory Committee, established by statute following disastrous fires in the 1940s, is an integral group to facilitate collaboration between the fire leagues, departments, and DFE.

STATE

The Forest Fire Program is working hard to develop increased visibility and stronger partnerships with Rhode Island state agencies, with the goal of creating efficiencies and improving interoperability and response. Currently, efforts are directed at increasing engagement with RIDEM Division of Emergency Response, RI Department of Public Safety, RI Fire Marshal's Office, and the RI Emergency Management Agency.

Programmatic Capacity

DFE's reduction in staffing has impacted the ability of the Agency to deliver a cohesive program. The Forest Fire Program has a staff of 4 (with 1 outstanding vacancy), straining its ability to address Preparedness, Suppression and Support, Equipment, Training, and Community Mitigation and Hazardous Fuels programming. It is fortunate that the incidence and size of fires have been diminished since the 1970s, as DFE is no longer able to provide robust response and leadership to support local wildfire suppression efforts. This reduction in large-sized fire occurrence has also resulted in a general lack of awareness on the part of



residents and a lack of engagement or sense of urgency on the part of local fire departments.

Program delivery is more than firefighting readiness, and includes:

- Provide training opportunities for fire departments/districts, including chainsaw safety, land navigation, fire behavior, and other department-specific requests;
- Manage Volunteer Fire Assistance (VFA) grant funding. These monies are used to organize, train, and equip fire departments in rural areas and rural communities (having a population of 10,000 or less) to suppress fires;
- Administer the Hose Loan Program to maintain a supply of clean and tested fire hose for fire departments/districts;
- Deliver an equipment-on-loan program for requesting fire departments;
- Assist with Community Planning to develop fire protection plans and prevention activities for schools, fire departments/districts, and municipalities as time and staffing permits;
- Manage the Federal Excess Personnel Property (FEPP)/ Firefighter Property Program (FPP);
- Hazard Mitigation Planning, and mitigation; and
- Fire Danger and Hazard Monitoring

PREPAREDNESS:

DFE Fire staff conduct several activities that facilitate and maintain a state of readiness including the analysis of current and predicted weather conditions, wildfire occurrence, and the presence and availability of vegetative fuels throughout the year, maintaining a continual assessment of wildfire risk. Utilizing this information, agency staff develop daily forecasts, to assist the state and local government entities in preparing for and responding to periods of elevated fire danger (i.e., fire seasons) as well as administering "Open Air" burn permitting and other restrictions.

Two technology challenges continue to impede the ability of the DFE Forest Fire Program to fully deliver preparedness planning and messaging:

1. Lack of fire risk mapping at a scale appropriate to Rhode Island's size: Due to the size of Rhode Island and the comparatively small parcel/project sizes, the 30- or 120-meter resolutions of the National and Regional Hazard Assessments are of limited use for management decisions. While these scales lend themselves well to broad landscapes, they are too coarse to capture the small-scale forest characteristics or changes in forest cover due to fragmentation and development in Rhode Island. Tools that can identify stand level data and cover/fuel type changes has been a missing foundational component of state hazard assessment and state lands management programs. Mapping tools or programs are needed in order to effectively develop management plans and implementation strategies. Insufficient staffing levels do not allow for the manual development of stand level data to manage state lands or to communicate and educate landowners, communities and fire departments for wildfire planning and mitigation. Efforts to access other federal funding sources to develop this capacity have been made and those efforts will continue.
2. Lack of up-to-date weather technology: Existing weather stations (Arcadia and Chepachet), while comparatively recent, lack compatibility with the GOES16 satellite system, and are unable to collect solar radiation data. The Forest Fire program is still using a manually calculated danger rating using **1967 indices**, which do not correlate well to more recent iterations. This system will be completely obsolete when the new, updated danger rating system is released in 2020.

Response planning is also a component of maintaining a state of readiness. This often includes engaging partners to identify and address areas of significant hazard, risk, or

challenges. DFE is working to increase the level of engagement with other state partners to ensure resources and information is exchanged freely. It is critical for DFE to be a part of the conversation when plans such as the [State Hazard Mitigation Plan](#) and the [Comprehensive Emergency Management Plan](#) are revised.

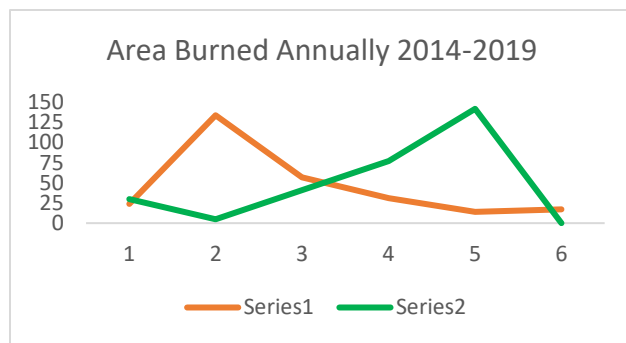
SUPPRESSION / SUPPORT:

Improving efficiency of the protection program including:

- firefighter training and testing to maintain a list of qualified personnel for in-state and out-of-state response;
- maintaining readiness of fire protection resources available both in-state as well as to other states (outside of Rhode Island's planned fire season).

Currently, due to staffing limitations, the qualified list is only comprised of DFE Fire Program staff. This requires DFE Forest Fire Program to successfully attract DEM and other state agency staff to commit to involvement, training, and maintenance for their readiness. While historically, Rhode Island has not needed to utilize the mutual aid services offered by the NFFPC, the Rhode Island Forest Fire Program is wholly dependent upon the NFFPC and the services provided.

While DFE support capacity and capability is severely limited with existing staffing levels, response to active fires remains a cornerstone of the Forest Fire Program and is critical in meeting the goal of minimizing the impact of event fires and fulfilling the statutory obligations of the Director of DEM. RIDEM is making progress in developing policies and procedures to direct and guide the Forest Fire program including: a State Fire Plan, Standard Operating Procedures, a formal training progression, and a strategies template to develop wildfire response (surge) capacity. Until surge capacity is developed, all forest fires that exceed the volunteer/municipal fire department capacity may require a declaration for a state of emergency. Additional work needs to be initiated for collaboration and information exchange to be institutionalized within DEM.



The acres of wildfires since 2014 and prescribed fire (Rx) by the Forest Fire Program.

TRAINING:

From 2014 to 2018, 589 firefighters attended training either directly taught or facilitated by the DFE Forest Fire Program staff. Delivering training programs is a priority of DFE, and is critical to address the short- and long-term goals of developing capacity and incident management skills, by providing training to volunteer firefighter and Forest Fire Program personnel in wildland fire fighting, firefighter safety and risk analysis, prescribed fire, usage of state forestry hose program, incident preplanning/complexity progression training, ICS, and Wildland-Urban Interface (WUI) Operations.

Besides the training progression, DEF is also increasing partnership efforts with NFFPC and local partners to increase in-state access to non-DFE or DEM staff. In 2019, the program, enabled by NFFPC, hosted an in-state Staging Area Manager course attended by 39 emergency and firefighting staff from across Rhode Island. Future educational courses will be planned and will assist in advancing the training progression efforts.

COMMUNITY MITIGATION AND HAZARDOUS FUELS:

The Forest Fire Program is committed to wildfire mitigation and prevention programs that help reduce hazardous conditions that, in turn, lower the risks from wildfires. The program focuses on outreach, planning, and implementation through public information and messaging from such programs as: Smokey Bear, Firewise, and Ready Set Go.

Increasing the ability of the Forest Fire Program to support municipal planning efforts in developing priorities and setting objectives was initiated from a 2015 [Wildfire Risk Reduction \(WRR\)](#) grant for a [Community Wildfire Protection Plan \(CWPP\)](#) for [Prudence Island](#).

While the project has been successful, additional time and effort will be required to further implement the preparedness messages for this first CWPP and for other communities statewide. The 2019 WRR grant awarded to DFE focuses on delivering the Firewise program and providing active technical support and developing in-state informational materials that will be made available online. This effort will include utilizing existing risk assessment tools, identifying communities at risk, and initiating proactive contact and follow-through with community leaders in these areas.

EQUIPMENT:

The Forest Fire Program currently maintains:

- a “strike team” comprised of six type 6 engines;
- one type 3 engine;
- specialized deployable kits available to fire departments and NFFPC members; and
- a forestry hose loan and maintenance program for 35 miles of forestry firefighting hose for fire department/district apparatus. This program is the basis for Rhode Island’s initial attack capacity and has been in place since the 1960s. The hose loan program remains a significant element of the Fire Program that requires a substantial time investment to maintain.



Humans cause most fires in Rhode Island with the potential to spread and impact multiple assets in areas of increasing density.



Hose laid out for cleaning; to be rolled and delivered to local fire departments.

Equipment maintenance is a critical component of maintaining a state of readiness. A priority for DFE is the development (and funding) of an equipment replacement plan as the majority of DFE's specialized equipment ages, depreciates, and can no longer be repaired. Due to budgetary constraints, large dollar items (such as vehicles) are currently on a 35-40-year replacement schedule. This is an unfeasible timeframe for second-hand vehicles and engines and requires a significant commitment of staff time to maintain, affecting reliability and the Forest Fire Program's ability to meet its fire responsibilities.

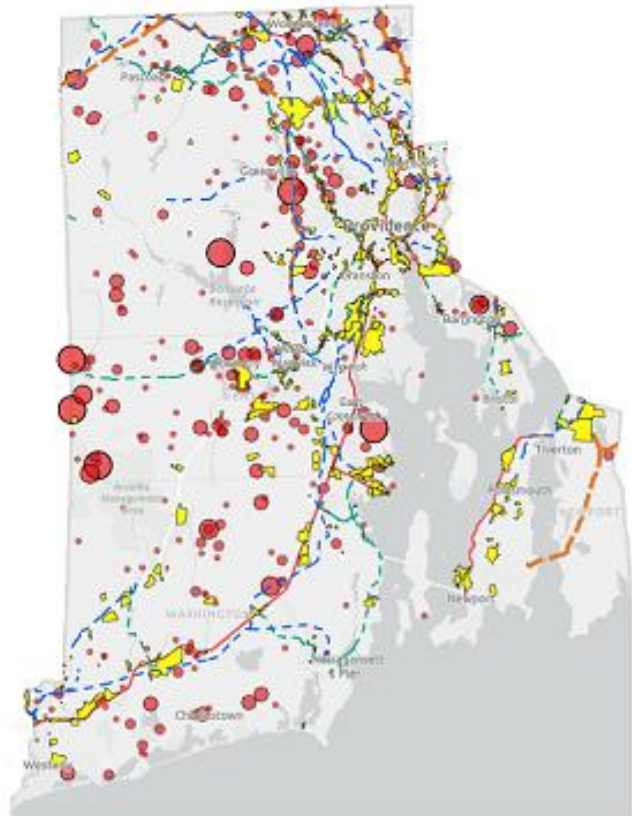
Program Priorities

Forest fragmentation increases as the population migrates from urban centers into adjacent forest land. As a result, fire departments are increasingly fighting fires within the Wildland-Urban Interface (WUI), defined as areas where homes are built near or among lands prone to wildland fire. The increased proximity to fire and more frequent fire ignitions exposes more residents, and their material assets ([values at risk](#)), to increased risk from wildfire. The vast majority of Rhode Island's fires are a result of human-activity carelessness and often burn within the home ignition zone. This close proximity to values-at-risk reduces the time available to respond, assess, plan, and attack fires. This results in

moderate to high consequence fire environments, characterized by:

- 1) the relatively high complexity due to the proximity and number of values-at-risk threatened, and
- 2) the high number of resources required to engage and control the fire.

These trends have been further exacerbated by the oak decline and mortality caused by several years of gypsy moth infestation and by trends of lower summer precipitation. The values at risk and the ecosystems that cohabit those areas are seeing increased fuel loading short-term, and change in fuel types long-term to more aggressive shrub fuel models better adapted to drier conditions, and dramatically increasing fire behavior; a dangerous combination.



This map shows a few of the assets at risk, related to recent RI fires: electrical transmission lines, urban industrial areas, natural gas lines, railways and roads. These are only a fraction of the values at risk should a large event wildfire occur. Homes, businesses and communities are scattered throughout Rhode Island amongst forest land.



Typical 0.2 acre fires located in populated areas, adjacent to forest fuels and structures, including garden and farm storage.

As a result, the Forest Fire Program’s priority is to address these high complexity response challenges appropriately, to the best of its capacity, including accessing additional grant funds like the WRR grants. Expanding public information and outreach and increasing planning and technical support efforts targeting communities and fire departments within the interface and intermix is the long-term and on-going priority of the Forest Fire Program.

Goals, Objectives, Strategies

Besides the S&PF National Priorities of Conserve, Protect and Enhance, the Forest Fire Program must also address the goals of the [National Cohesive Wildland Fire Management Strategy](#) (NCS):

1. **Restore and Maintain Landscapes:** Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
2. **Create Fire Adapted Communities:** Human populations and infrastructure can withstand a wildfire without loss of life and property.
3. **Improve Wildfire Response:** All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

GOAL 1: *Conserve* forest resources and ecosystems by supporting resiliency-focused management. (NCS: Restore and Maintain Landscapes)

Objective 1.1: Develop and expand existing planning and hazard monitoring capacity.

Strategy 1.1.1: Pursue funding opportunities for fire risk mapping at a scale appropriate to Rhode Island for planning and prioritization.

Strategy 1.1.2: Pursue funding opportunities to purchase NFDRS compatible weather stations to update fire danger tracking and national reporting capability.

Strategy 1.1.3: Use improved planning capacity to establish fire program priorities for land management on state lands.

Strategy 1.1.4: Work with partners to assist landowners, municipalities, and agencies to address fire adapted ecosystem management.

Objective 1.2: Increase capacity for implementation of management recommendations to achieve resiliency goals.

Strategy 1.2.1: Work with partners to develop prescribed fire crew capacity and qualifications.

Strategy 1.2.2: Identify opportunities to employ alternative fuel treatment methods, like herbicide application and mechanical treatment.

Goal 2: *Protect* communities and their ecosystems from negative impacts of wildfire. (NCS: Improve Wildfire Response)

Objective 2.1: Develop in-state wildfire response (surge) capacity and specialist skills.

Strategy 2.1.1: Identify and initiate training for DFE, DEM and other state employees to meet Type 3 incident management needs.

Strategy 2.1.2: Increase local fire department's basic proficiency for wildfire suppression and safety.

Strategy 2.1.3: Work with state agencies and lawmakers to develop an updated emergency hire program.

Objective 2.2: Improve communication between in-state partners and responders.

Strategy 2.2.1: Work with RIEMA to improve and increase interaction and partnerships, and implementation of communications interoperability.

Strategy 2.2.2: Continue to host Forest Fire Advisory Committee meetings and improve fire departments and partners access to fire hazard, prevention, suppression, training, and preparedness information.

Objective 2.3: Maintain fire response capacity.

Strategy 2.3.1: Leverage Hose program efforts to increase Fire Department engagement in surge capacity development.

Strategy 2.3.2: Maintain agreements with Federal partners and NFFPC for response, and address barriers to resource sharing.

Strategy 2.3.3: Maintain or replace specialized equipment to ensure initial response capacity.

Goal 3: *Enhance* public benefits from trees and forests to Rhode Island communities and residents by developing increased resiliency to wildfire. (NCS: Create [Fire Adapted Communities®](#))

Objective 3.1: Increase public awareness of wildfire and the need for preparedness.

Strategy 3.1.1: Develop education/awareness outreach, utilizing existing programs like [Firewise](#) and [Ready- Set-Go](#)

Strategy 3.1.2: Work with state partners to incorporate wildfire into environmental hazards preparedness messaging.

Objective 3.2: Incorporate a Firewise approach to wildland urban interface areas.

Strategy 3.2.1: Identify communities at risk through hazard assessment and developing fuel management strategies.

Strategy 3.2.2: Provide technical assistance for communities to develop fuel management strategies and/or Community Wildfire Protection Plans (CWPP).

Strategy 3.2.3: Pursue funding to assist communities with plan development and implementation costs.

Forest Health Program

Program Description

The goal of Rhode Island's Forest Health Program is to protect, enhance, and conserve the health and sustainability of forest resources and, therefore, the values they provide. Distributed through the Rhode Island Division of Forest Environment (DFE), the program is funded by two federal match programs which support national priorities and state activities:

- The [Cooperative Forest Health Protection](#) (CFHP) allocation in the Forest Service directives ([FSM 3400](#), Chapter 3430) is a minimum of \$60,000. Activities include ground-based surveying, outreach and education, training and technical assistance. It is required to have a full-time forest entomologist or plant pathologist on staff.
- The [Forest Health Monitoring](#) (FHM) component promotes the collection of forest stress and disturbance data on Federal, State, tribal, and private lands using nationally standardized methods and data fields. The data is collected through aerial and ground surveys using [Digital Mobile Sketch Mapping](#) (DMSM) codes, standards, and format. Allocation of FHM base funding (\$23,000) is based on the number of participating States and acres of forested land in those States.

These programs fund activities to detect and monitor threats to Rhode Island forests, to evaluate forest health conditions, and to inform and educate others about the status of known and possible threats, and future conditions of the forest resource.

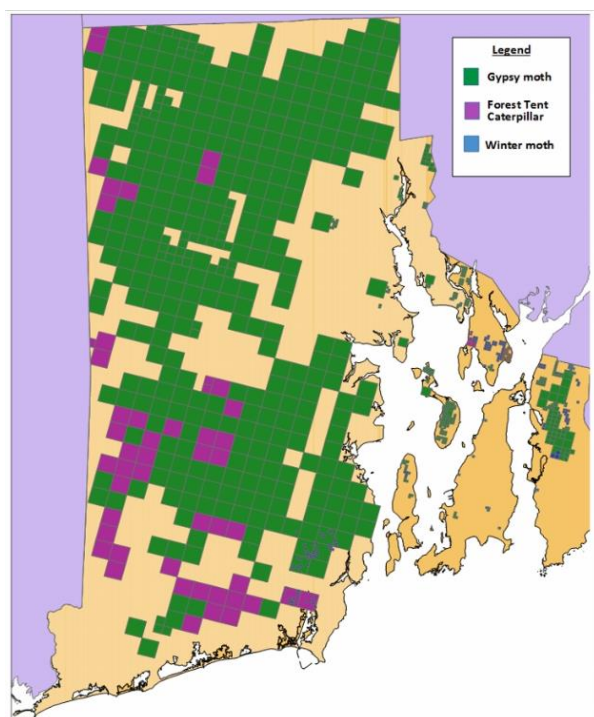
Surveying is the fundamental tool used in the Forest Health Program, from soliciting/collecting information from the public via phone calls, mailings, conversations, or social media, to monitoring forest health plots situated around the state. The same platforms and opportunities are used to disseminate information and/or provide technical

assistance. CFHP activities are critical in the conservation, protection, and enhancement of the forest and include surveying, monitoring, outreach, trainings, technical assistance, cooperative assistance with partners and cooperators, and the evaluation of the collected information.

The CFHP in Rhode Island utilizes the same scientifically recognized and accepted survey protocols as other programs across the country to ensure consistent, valid data is collected. Protocols are in place for trapping (sticky traps, funnel traps), collecting with insect nets, or creating "trap trees" (a tree deadened or felled for the purpose of luring insect pests). For some insects, laboratory rearing from the larval stage to adults is required. Methodology is based on such considerations as the damage causing agent (DCA), tree species, lure availability, site parameters, purpose of the survey, etc.

While the CFHP program relies on ground-based activities, FHM involves aerial detection surveys (ADS) of the state's forested landscape to map canopy damage, defoliation, discoloration and/or tree mortality, to identify the cause of those problems, and to evaluate the risks that those threats pose. Mapped areas are "ground-truthed" to confirm the DCA.

In Rhode Island, common pests include: winter moth (*Operophtera brumata*), forest tent caterpillar (*Malacosoma disstria*), gypsy moth (*Lymantria* spp.), hemlock woolly adelgid (*Adelges tsugae*), orange-striped oakworm (*Anisota senatoria*), and southern pine beetle (*Dendroctonus frontalis*). On occasion, unanticipated DCAs or events (fire, weather events, human activities, etc.) require assessment. For example, in 2018, emerald ash borer (EAB) was confirmed and spotted lanternfly (SLF) (*Lycorma delicatula*) is aggressively advancing in the northeast.



2017 Defoliations by DCA.

FHM also relies on on-line tools, such as the USFS [Forest Health Assessment & Applied Sciences Team's](#) (FHAAS) "[Forest Disturbance Monitor](#)" (FDM). The FDM tool uses remote sensing to detect incremental changes in the "greenness" (deviation in how green the canopy should be compared to what it had been in the past few years) of small patches (about 16 acres) of the forest canopy. Monitoring and evaluating this data can provide warnings that the identified area may be experiencing a forest health threat and requires further investigation.

Strategic Partnerships

University of Rhode Island: [Department of Plant Sciences and Entomology](#)

DPE is a state forest health partner without a permanent entomologist or plant pathologist on staff. To meet the national requirement for funding, DPE annually requests a waiver from this requirement and submits a detailed plan for approval that demonstrates how the CFHP program will be implemented and monitored.

The University of Rhode Island (URI) is an essential partner in program delivery and fulfills the role of entomologist required for the federal funding. A yearly contract with URI

allows the Forest Health Program to meet the national requirement and supports a close working partnership.

URI assists in the identification of forest damage-causing agents and, as necessary, propagation of suspect plants, insects, and pathogens for identification. URI also provides technical assistance to landowners and cooperates with the FHP on projects such as the rearing and release of species utilized in an approved integrated pest management program (biocontrol). URI also conducts surveys for forest damage causing agents in furtherance of the stated goals of FHP, and otherwise advises on pest management strategies including participation at workshops and/or training sessions.

Department of Environmental Management: [Division of Agriculture](#)

The Division of Agriculture (DAG) is the State lead agency for the implementation of the [Cooperative Agricultural Pest Survey](#) (CAPS) which focuses on agricultural pests, some of which can impact forest resources. Issues that affect forest environments require partnerships for outreach and messaging to all stakeholders. Combined efforts and shared data and analysis are essential elements of this partnership.

Additional partners are also recipients of data collection (compiled and analyzed) such as Conservation Districts, cooperators like Forest Stewardship Program landowners, and non-profits such as RI Forest Conservators Organization (RIFCO). State data, combined with the results of data collected by other states, present a perspective of forest conditions at regional and national scales. Sharing this data enhances the health of forests in each state.



Looking for EAB Larvae: Bark Peeling.

Programmatic Capacity

The Forest Health Program is managed by one full time staff person, with one seasonal (6 month) employee (as available). Coordination with program partners is integral to successful program outcomes. For example, some types of surveys or trapping are undertaken with URI on a geographical basis; messaging may be hosted/disseminated by URI, DAG and/or DFE depending on the type of pest or disease and the target audience. The additional threats posed by new pests (e.g. EAB and SLF) increase the need for more surveys, tracking, delimiting, and reporting. These activities all require an overall increase in time and effort from all partners.

Not including aerial detection flights, significant time is spent:

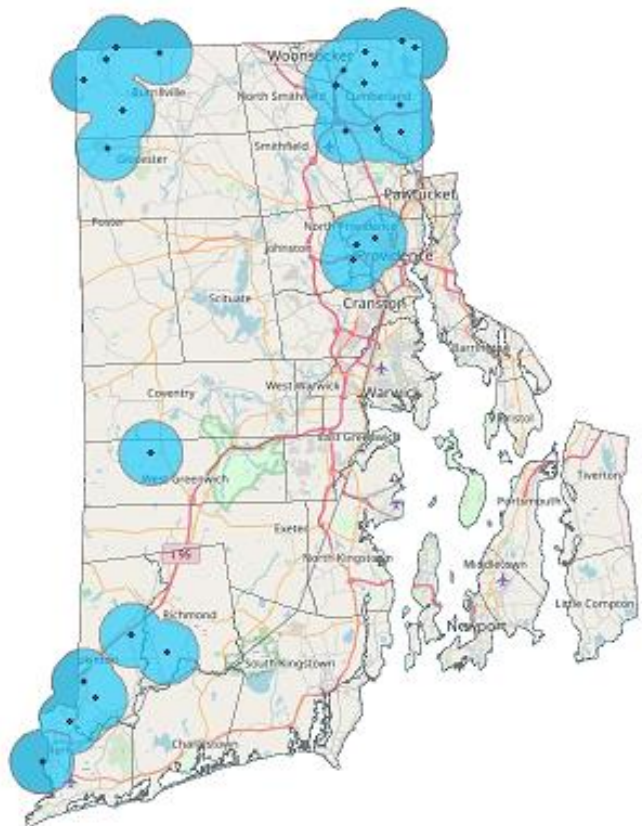
- Undertaking statewide gypsy moth surveys, (counting egg masses was a monumental task during the epidemic outbreaks in 2016 and 2017).
- Monitoring Eastern white pine needle damage. WPND has recently been noted, although the pines do not appear to have suffered harmful impacts to date.
 - Long term monitoring plots have been established regionally to monitor changes.
- Surveying for the native southern pine beetle, recently found in Rhode Island, indicates the species continues to thrive regionally, but has yet to cause the type of damage and mortality seen in other parts of its range (predominantly the SE).
 - Monitoring for population changes is continuing.
- Detecting EAB using the *Cerceris* bio-surveillance protocol, now supplemented by ash trap tree establishment and baited lindgren funnel trap installation.
 - Information from these surveys is vital as communities prepare for the impact to ash resources.
- Mapping winter moth damage. WM has expanded its range into Rhode Island, periodically causing severe canopy

defoliations (especially to red maple), particularly in the coastal zone.

- As red maple is the state tree of Rhode Island, the threat to this resource is of particular interest.

Additional Issues being monitored include:

- Two-lined chestnut borer (*Agrilus bilineatus*) (identified as a possible source of secondary mortality of Gypsy moth damaged oaks)
- *Cynipid* gall wasps (Oak mortality)
- *Phytophthora ramorum* (various types of damage)
- Oak wilt (*Bretziella fagacearum*) (decreased vigor and/or mortality)
- Beech bark disease (insect/disease complex: *Cryptococcus fagisuga* and *Neonectria* spp) causes Beech mortality)



EAB trapping in 2019 shows locations where adults were caught using lindgren funnel traps. The blue boundary indicates a two-mile radius, the extent the infestation is presumed to have reached. 2020 trapping will start on these boundaries to further delineate the extent of infestation in Rhode Island.

In addition, DFE has adopted The Nature Conservancy's [Don't Move Firewood](#) campaign as a proactive protection step to prevent the introduction and slow the spread of invasive species. The FHP disseminates outreach materials to RV parks, campgrounds, and other appropriate facilities, and venues as part of Rhode Island's forest protection outreach. Informing the public at these outlets has a direct impact at a point source for potential infestations that reaches beyond the property boundaries of the facility, since the movement of firewood has been identified as the major vector for the transportation of forest pests into un-infested areas.

Program Priorities

Similar to the other Cooperative Programs, land use change and development pressures present the greatest challenge to forest health. Sprawl and transit corridors provide multiple pathways and opportunities for the introduction and spread of native, invasive, and naturalized insect pests, plants, and pathogens, many affecting tree species and habitats. But urban problems don't remain urban and rural forest health is impacted, whether through competition, decline or mortality, or loss of synergistic flora and fauna. The popularity of recreation exposes trails and campsites to hitchhikers in or on vehicles travelling from infested to non-infested areas, and through the movement of infested firewood or wood products. Since forest health issues cross state boundaries, a regional approach to management is often required, necessitating cooperation with partners within the region, as well as continued vigilance within Rhode Island.

Priority areas where educational efforts can be targeted and are prime locations for trapping pests include locations where sprawl and development are occurring (typically immediately adjacent to existing urban areas, and in areas of high human activity, such as campgrounds). However, rural forests remain a priority given that mortality and regeneration, changes in species mix, and chronic stressors can affect habitat and forest characteristics for generations.

Goals, Objectives, Strategies

Goal 1: Promote the **conservation** and management of Rhode Island's forests through practices that address forest health and resiliency.

Objective 1.1: Develop and deliver information on multiple platforms that addresses the identification and management of forest insect, disease, and non-native invasive threats.

Strategy 1.1.1: Develop messaging that emphasizes a landscape approach to tree and forest management and threat response, incorporating shared messaging from other DFE programs: Stewardship, Fire, and Urban Forestry.

Strategy 1.1.2: Utilize internal and external social media platforms and websites such as DFE's [Current Threats to Forest Health](#), and [Don't Move Firewood](#) to inform and prevent the spread of invasive pests.

Strategy 1.2.3: Utilize survey and monitoring data to assist management efforts that further Forest Health Program goals.

Objective 1.2: Increase collaboration with local partners' management efforts to address forest health.

Strategy 1.2.1: Share latest techniques and protocols for identification and management of current forest threats.

Strategy 1.2.2: Pursue funding opportunities for alternative treatment methods and biocontrol response to damage causing agents (DCAs).

Goal 2: *Protect* Rhode Island's forests by monitoring and evaluating forest health conditions and threats.

Objective 2.1: Survey for native and non-native forest insect and disease threats and monitor for their outbreak and spread.

Strategy 2.1.1: Maintain federal collection protocols for priority species and complexes.

Strategy 2.1.2: Assess effectiveness and adapt methodology of state gypsy moth plots as appropriate.

Objective 2.2: Work with regional and national partners to disseminate current information about the biotic and abiotic threats to Rhode Island's forests.

Strategy 2.2.1: Attend regional and state meetings to share and exchange information and efforts.

Strategy 2.2.2: Establish Rhode Island representation on the [Northeastern Forest Fire Protection Compact](#) (NFFPC) *Forest Health Working Group*.

Goal 3: Enhance public benefits from trees and forests through promotion of practices and programs that address threats to forest health.

Objective 3.1: Expand stakeholder engagement in collecting forest health information and disseminating forest health messaging.

Strategy 3.1.1: Engage local stakeholders with trapping and monitoring efforts by providing materials and training and promoting local efforts on social media and public workshops/presentations.

Strategy 3.1.2: Continue to support local partners (such as RI Conservation Districts, Envirothon, and RI Forest Conservators Organization (RIFCO)) by sharing data and information and participating in outreach efforts to professionals and the general public.

Objective 3.2: Maximize messaging effectiveness by increased coordination with partners for responses regarding threats to Rhode Island's forests.

Strategy 3.2.1: Continue to collaborate with primary in-state partners, URI and RIDEM Department of Agriculture, on developing consistent messaging across programs and platforms.

Strategy 3.2.2: Maintain engagement with Federal and other State Forest Health counterparts for updating, coordinating and assisting with regional forest health efforts and initiatives.

Forest Stewardship Program

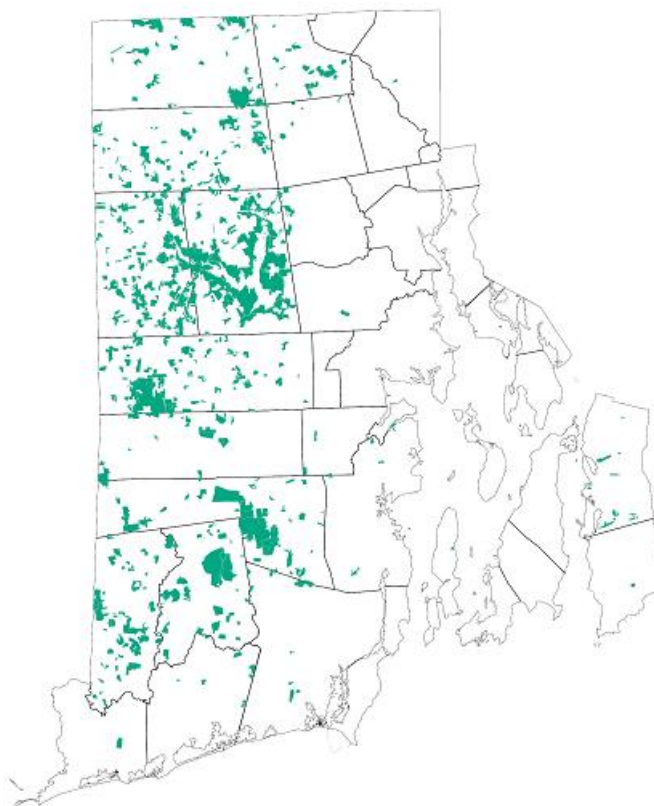
Program Description

The Rhode Island [Forest Stewardship Program](#) (FSP), under the US Forest Service, serves to promote and support active forest management on non-industrial private forest lands (NIPF). Through the Rhode Island Division of Forest Environment (DFE), this program provides NIPF owners with access to professional and technical assistance. In Rhode Island, this assistance includes:

- Maintenance and delivery of the Forest land Classification current use taxation program
- Site visits to forest landowners requesting technical assistance
- Education and outreach for both landowners and the general public
- Timber harvesting permitting and BMP education for landowners and loggers
- Dissemination of information on education and funding opportunities

The Rhode Island FSP is also responsible for tracking land-use change and ownership patterns, seeking out new programmatic opportunities, and exploring creative, flexible ways to serve the needs of Rhode Island's people and forests.

Landowner participation in the FSP is driven by the current use program that allows lower land tax valuations for lands under Forest land Classification (FLC). To maintain FLC under the Rhode Island [Farm, Forest, and Open Space Act](#) (FFOS), NIPF owners must actively manage their forest land according to federal FSP standards. While FFOS requires a landowner to manage 10 or more acres of forest land to qualify for FLC, all NIPF owners in the state are eligible for assistance from the FSP and can request assistance at any time. Outreach and education are also available to any groups requesting relevant assistance, including presentations, guided walks, or workshops.



Forest land enrolled in the FFOS Program, 2019.

Strategic Partnerships

Personnel and resource limitations requires the Stewardship Program to rely on close associations with partner groups. Currently, an MOU between [Natural Resources Conservation Service](#) (NRCS) and DFE is in place that recognizes the importance of Rhode Island forest management and makes provision for close cooperation and collaboration between the programs to provide and deliver technical assistance to NIPF owners.

The [Rhode Island Woodland Partnership](#) (RIWP) is a local partner organization drawing from public agencies, small businesses, and non-profit organizations, to meet shared stewardship goals. The broad membership representation allows RIWP to act as the Stewardship Advisory Council for periodic meetings and input.

Other partner groups include:

- [Rhode Island Forest Conservators Organization](#) (RIFCO)
- [Rhode Island Resource Conservation & Development Council](#) (RIRC&D)
- [Rhode Island Association of Conservation Districts](#) (RIACD)
- [RI DEM Division of Fish and Wildlife](#) (DFW)
- [American Tree Farm System, Rhode Island Council](#) (ATFS)

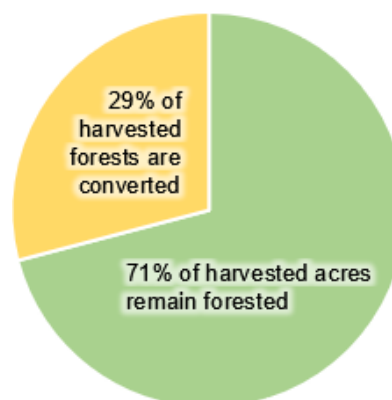
Program Priorities

Stewardship Program priorities include mitigating the effects of urbanization by promoting the protection and management of swaths of undeveloped and contiguous forest land in Rhode Island and promoting forest management in the wildland-urban interface (WUI). By percentage of urban land, Rhode Island is the second most developed state in the US, so every acre of remaining forest land is crucial for the health of both the human and wildlife populations of this state.

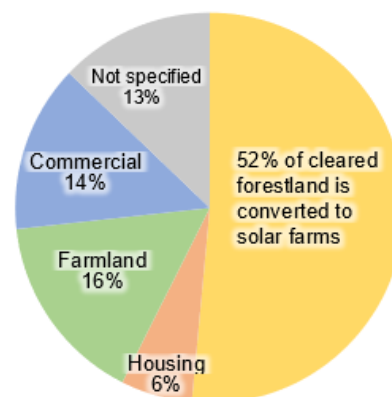
Currently, the pressures to develop private forest lands remain steady and are increasing as the state recovers from the Great Recession. Trends over the last two years indicate that nearly a third of all timber harvesting in Rhode Island results in permanent land conversion (Fig. 1), the majority of which is due to pressures from alternative energy development (Fig. 2). Landowners may not continue to manage and maintain their lands as forest if they perceive a lack of value and support for forest management – to the detriment of all of Rhode Island and its inhabitants. By providing private landowners with technical assistance, education, and outreach, the FSP acts as a support system for forest landowners.

Forested areas under the greatest conversion pressure - those in which the most forested acreage is being permanently converted - are rural areas with cheaper land and higher taxes relative to other towns in Rhode Island (e.g. Hopkinton, Foster). Exurban and wildland-urban interface areas continue to face steady

pressures from housing development, resulting in fragmentation from small house lots and subdivisions carved from contiguous forest.



Conversion of forest land based on harvesting permit data (2018 - 2019). Of all harvested forest land acreage, 29% is deforested for permanent conversion to other uses.



Use of converted forest land based on harvesting permit data (2018 - 2019). Of all deforestation occurring via permitted harvesting, more than half is converted to solar energy farms and 16% to conventional agricultural uses.

This priority focus for the FSP coincides with the modernization efforts underway on national and regional levels and addresses the four critical issues of concern. By targeting remaining contiguous forests in rural western Rhode Island and in the Sakonnet landscape of Tiverton and Little Compton, as well as the interface and exurban areas in Rhode Island, active forest management addresses the issues of concern:

- **Reducing wildfire risk to communities** through active forest management and maintenance of trails within properties.
- **Protecting water resources** by monitoring water quality protection during harvesting, retaining forests adjacent to waterways, and promoting conservation of forests in important watersheds.
- **Enhancing wildlife habitat** through active forest management including successional intervention, invasive species control, and forest health improvement.
- **Supporting jobs in the woods** via retention of working forest lands.

The demand for land for development and other uses resulting in permanent land conversion is increasing and landowners must be supported and educated on the value and benefits of managing their forests as forests. Without active and consistent efforts, many landowners will succumb to the enticement of selling their land. The FSP acts as a support system for forestland owners by providing private landowners with technical assistance, education, and outreach.

Goals, Objectives, Strategies

Goal 1: Promote *conservation* of non-industrial private forest land (NIPF).

Objective 1.1: Increase NIPF certified under the Forest Stewardship Program through targeted outreach to landowners in cooperation with partner groups.

Strategy 1.1.1: Identify key areas of qualifying NIPF and target outreach efforts toward landowners in these key areas to increase awareness about both the Forest Stewardship Program and the importance of sustainable forest management.

Strategy 1.1.2: Continue to promote the current tax provisions of the FFOS Act as a tool to conserve forestland and work with municipal tax assessors to reach eligible landowners.

Objective 1.2: Promote forest management and conservation within spatial communities of small landowners (with less than ten contiguous acres) using a landscape-scale approach.

Strategy 1.2.1: Develop a landscape-scale management framework to benefit small landowners in Rhode Island (>10 acres) who do not qualify for FLC under FFOS.

Strategy 1.2.2: Identify key areas of small landowners with potential for collaborative management and provide outreach to encourage forest management under the landscape-scale management framework.

Objective 1.3: Maintain Rhode Island's active involvement in regional and national Cooperative Forest Management (CFM) committee.

Strategy 1.3.1: Attend annual regional NMSFA CFM committee meetings and biennial national CFM committee meetings.

Strategy 1.3.2: Utilize the Forest Stewardship Committee (RIWP) to advise Stewardship Program activities.

Goal 2: *Protect* private forest land from development and degradation.

Objective 2.1: Maintain lines of contact and support structures for NIPF owners, via onsite visits, meetings, informational exchange, and site inspections.

Strategy 2.1.1: Educate NIPF owners on forest fragmentation prevention, sustainable forest management, and conservation-based estate planning.

Strategy 2.1.2: Cooperate with the Rhode Island Forest Fire Program to provide NIPF landowners with wildfire protection and prevention resources.

Objective 2.2: Provide access to and information on relevant current events, partner group initiatives, and funding opportunities.

Strategy 2.2.1: Increase NIPF owner awareness of programs available through collaborative and partner group efforts, such as the “Forestry for Rhode Island’s Birds” program.

Strategy 2.2.2: In cooperation with partners, provide outreach and education to tax assessors, realtors, and public officials on the importance of opportunities for landowners to protect NIPF from development and degradation.

Objective 2.3: Promote forestry BMPs, especially in regard to harvesting operations, which should be inspected prior to harvest and during operations.

Goal 3: Enhance forest resources and ecosystem services of private forest lands.

Objective 3.1: Promote active, sustainable forest management supporting wildlife habitat diversity, structural diversity, and understory health to owners of both managed and unmanaged forest land.

Strategy 3.1.1: Provide education and outreach on: (1) invasive species identification and control, and (2) insect and disease recognition and response.

Strategy 3.1.2: Provide education and outreach on the importance of sustainable forest management in supporting fish & wildlife habitat, improving watershed function, and contributing to air quality.

Strategy 3.1.3: Encourage landowners to seek assistance from qualified natural resource professionals.

Objective 3.2: Promote good silvicultural practices, backed by sound science, to support forest health, ecosystem resiliency, wetland conservation and watershed function, wildlife habitat, and carbon storage.

Strategy 3.2.1: Support best management practices (BMPs) for forest management through education and follow-up.

Strategy 3.2.2: Promote silvicultural practices that support a diversity of forest structures and habitats, especially for threatened & endangered plant and wildlife species and those vulnerable to suburbanization and fragmentation.

Objective 3.3: Provide education and outreach on forest management for important forest ecosystems, highlighting the relationships of private forest land to wetlands and water quality, air quality, climate protection, and urban-rural interface values.

Strategy 3.3.1: Promote “Call Before You Cut” program to educate landowners before timber harvesting.

Strategy 3.3.2: Provide education and outreach to groups outside of NIPF owners, such as community groups, policy makers, and schoolchildren, with specific focus on the universal benefits of private forestland conservation and management.

Strategy 3.3.3: In cooperation with partner groups, inform and educate state and local government officials of the need to provide sound policies for the funding, protection and enhancement of private forest resources.

Urban and Community Forestry Program

Program Description

The goal of the Rhode Island Urban & Community Forestry Program (U&CF) is to support communities in developing sustainable urban forestry programs that enhance the environmental, economic, social, and health benefits that healthy trees and forests provide. U&CF aims to do this by assisting communities with the:

- Development of urban forest resource assessments and management plans
- Development and review of tree ordinances and policies
- Education of citizens, private industry, agencies, and community groups on tree establishment and management
- Establishment or improvement of the effectiveness of advocacy and advisory organizations

To a degree, Rhode Island's forest land has benefited from the industrialization and movement of population from rural to urban areas in the past century, as well as the migration of industry and manufacturing out of the state. Even the slow recovery from the Great Recession has buffered the rate of development and land conversion. But this recovery and reprieve is coming to an end as populations grow and expand both in Rhode Island and in neighboring states.

In Rhode Island, municipalities are facing development pressures that result in forest land conversion, from traditional house lot construction to solar field installations. These municipalities are generally not prepared to address these demands in a way that best represents community identity and character; most communities have no or limited ordinances that address trees and landscape within infill or new development sites. Tree maintenance is typically a reactive event with limited proactive planning.

And, while Rhode Island requires all people working in arboriculture have a state license, to a total of nearly 700 active licenses in 2019, there is no required on-going education requirement.

The opportunity and need for technical support and assistance for communities, professionals and residents in Rhode Island rests on the base funding received for the Urban & Community Forestry Program (\$200,000 per year). To be eligible for base funding requires:

- full-time program coordinator
- full-time or equivalent volunteer/partnership coordination capacity
- active state advisory council, and
- current 5-year plan that may be included in the State Forest Action Plan (as is here)

Unlike most states that receive base funding, Rhode Island utilizes some of that base funding to deliver a small subgrant program (typically \$30,000 per year) awarding ~10 small subgrants.

Strategic Partnerships

Rhode Island provides funds to the RI Tree Council (RITC) through a cooperative agreement to fulfill the required volunteer coordinator position necessary to receive federal funding; due to funding limitations, and managing the subgrant program, Rhode Island does not have a volunteer/partnership coordinator employed in State service. RITC manages the champion tree registry, plans and organizes the State Arbor Day, delivers a myriad of public education programs including the extensive Tree Stewards Program, works with municipalities (e.g. the Set-Back Tree Planting Program with three active municipalities in 2019), and represents the U&CF Program throughout the state, providing education and engagement opportunities in urban and community forestry for Rhode Island citizens.

The U&CF Program provides support or technical assistance to other small or local non-profits and tree boards around the state where support or technical assistance is needed. However, there are multiple opportunities to work with other State Agencies, providing technical support and advocating for trees. In particular, opportunities have been identified to increase engagement with:

- RI Department of Environmental Management [State Parks](#): aging and decaying trees, Emerald Ash Borer, planning and replanting strategies, greenway issues
- RI Department of Environmental Management [Division of Agriculture](#): Invasive pests and diseases affect local agriculture and local forest environments requiring partnerships in outreach and messaging to all stakeholders
- RI Department of Health [Health Equity Zones \(HEZ\) Initiative](#) is a partner for the project funded by American Forests for the RI Urban Forests for Climate and Health initiative
- RI [Emergency Management Agency](#) is increasing engagement with the DFE Forest Fire Program, but opportunities for U&CF to promote the inclusion of trees in emergency planning and to support communities through U&CF's involvement with the 2019 NUCFAC: *The Accessible Community Tree Inventory: Expanding State Capacity for Planning and Risk Management*

A final significant partnership, since 2015, is the funding received through the [RI Regional Greenhouse Gas Initiative](#) that funds the Energy-Saving Trees Program, described further below. The [Arbor Day Foundation](#) is essential in implementing this effort.

Programmatic Capacity

Beyond the technical support and partnerships, the U&CF program delivers or manages several efforts:

U&CF SUBGRANTS

Since 1990, the U&CF program has made a portion of their base funding available for subgrants ranging from \$1,000-\$4,000, with a 60/40 match requirement. At one time grant monies were as high as \$100,000, but in recent years has held steady at \$30,000. Applications from municipalities and varied non-profits and applications are reviewed with the RITC Board. Traditionally, many of the projects are related to tree planting, but the U&CF Program encourages applications for planning and management through its review process where funding priority is given to projects that advance a community's urban forest management program, provide training to public agency staff, educate the public on urban forestry issues, or promote tree planting in low-to-medium income communities with below-average tree canopy cover.

ENERGY-SAVING TREES

A successful grant-funded partnership with The Arbor Day Foundation in 2015 through their [Energy-Saving Trees](#) Program (EST) led to an extension of the partnership funded by Rhode Island's [Regional Greenhouse Gas Initiative](#). Two tree giveaways are offered June and September, for 1,000 trees each.



Since the EST program's inception, Rhode Island has planted 11,400 trees around RI residences to reduce heating and cooling costs. An initial survivability study was conducted on the fall 2015 giveaway season one year after their planting and found 78% of trees were planted correctly and still alive; additional survivability studies have not been conducted due to short-staffing and funding. Interest in the program remains high and all trees are typically reserved within a week. Any unclaimed trees are given to RITC which uses them as part of their outreach and planting efforts.

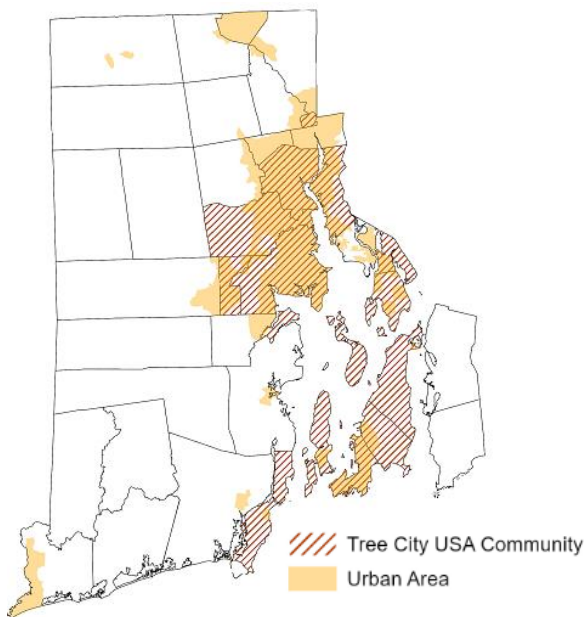
U&CF partners with the [RI Nursery and Landscape Association](#) (RINLA) to facilitate the EST program. RINLA is a statewide 501(C)3 that promotes the green industry and supports the marketing of green industry good and services throughout Rhode Island. Through the partnership with RINLA trees are stewarded throughout the duration of the season and delivered to each of the 4 giveaways locations.

TREE CITY USA & TREE CAMPUS USA

The U&CF program administers these Arbor Day Foundation programs with [13 municipalities](#) and [one university](#), Salve Regina University, all in the eastern, and highly-populated, side of the state.

There are 39 municipalities in Rhode Island, many which are, or have, highly rural areas associated with them, which will be targeted in future outreach efforts.

National Grid services over 95% of Rhode Island and is recognized as a Tree Line USA utility company in Massachusetts. Obtaining a local designation is a clear target for the program.



STATE ARBORIST LICENSE

Rhode Island State General Law regulation, [§2-19-2](#), requires that “any person, firm or corporation desiring to engage in or practice the art or trade of arborist, ..., shall obtain a license to engage or practice from the director

of environmental management.” The U&CF Program manages the yearly renewal of state licenses, which also administers the qualifying exam four times a year. Nearly 700 licenses were issued in 2019. This contact list will be the basis for offering regular training and workshop opportunities to arborists and allied green industries, to encourage voluntary continuing education.

MUNICIPAL TREE WARDENS

Rhode Island State General Law regulation [§2-14-2](#) establishes the requirement that all Rhode Island municipalities have a Tree Warden, who shall be a licensed RI arborist, appointed each January by the town council or mayor. While some appointments are licensed staff or consultants, other municipal staff, such as planners or public works, may have the responsibility added to existing duties. Providing on-going education to Tree Wardens, as well as technical support, has been enhanced with the start of regular workshops targeting Tree Wardens.

TECHNICAL SUPPORT & EDUCATION

The U&CF Program seeks to leverage its modest resources to serve the greatest number of Rhode Islanders possible. It does this primarily by its programs but also by providing technical urban forestry services to groups, including cities and towns, environmental non-profit organizations, schools, tree care professionals, and others. Increasing access and engagement on-the-ground is a priority. Recent efforts include the purchase of a [resistograph](#) which will allow education and direct observations on tree structural integrity, and the start of yearly workshops targeting tree wardens and professionals each spring and fall. These workshops will increase education opportunities, expanding on the existing audience focus by RITC which mainly targets individuals and building volunteer capacity.

Program Priorities

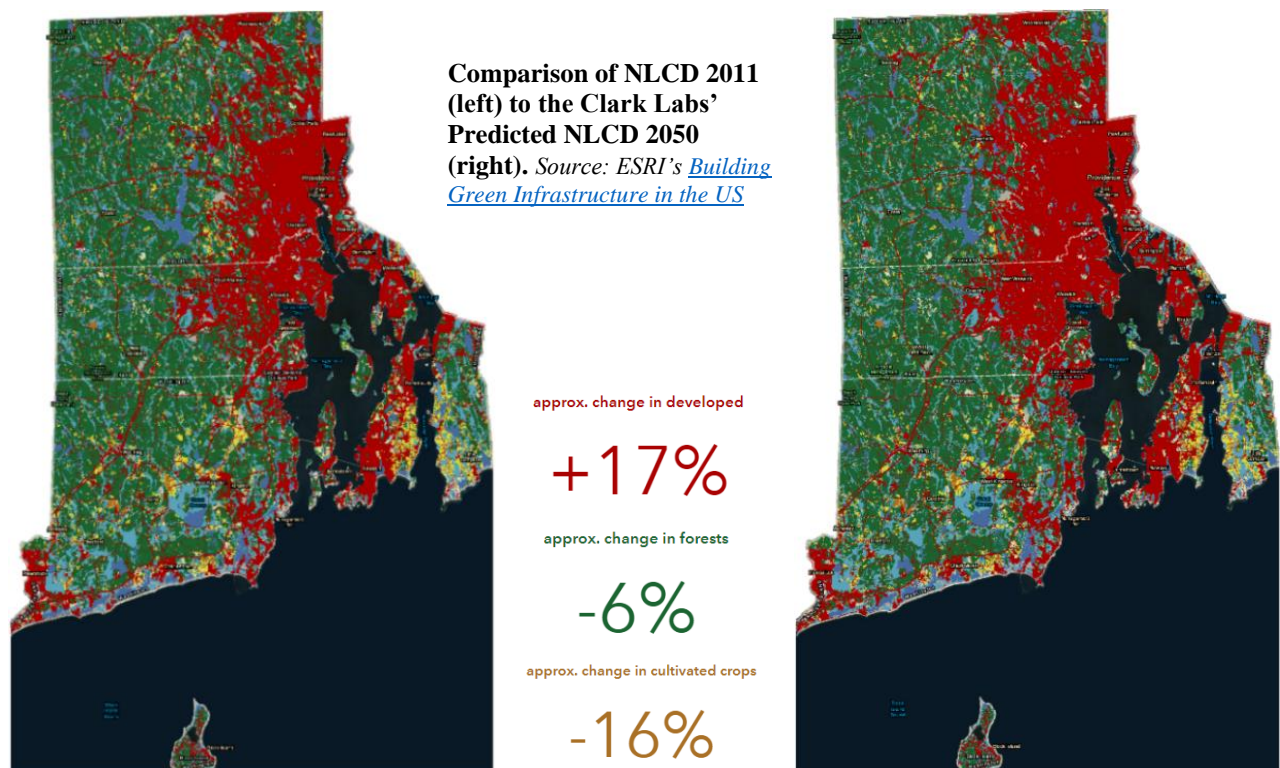
The U&CF Program is multi-faceted and works with groups from large urban centers to small unincorporated communities and all that lies in-

between, including wildland-urban interface and intermix. Ever the advocate for trees and their proper management, the entire environment has come under the purview of U&CF professionals. Trees not only provide multiple and quantifiable economic benefits, but they also play a significant role in the environment and habitat needs of humans and flora/fauna.

Increasing public awareness and expanding education efforts are one element to encourage improved municipal management planning. But, like Rhode Island's own U&CF Program, most communities are operating on a shoestring budget, if they have a budget for urban tree programming at all. These limitations seriously affect the ability of the U&CF Program to lead or support efforts to address the impacts of increasing urbanization, protect community values and culture, maintain landscape functionality, and plan for catastrophic events. Information is only one part of the equation; implementation is the other. Limited funding affects the ability of the U&CF Program and RI's municipalities to carry out substantive efforts.

Rhode Island's small size allows U&CF to make direct and personal connections with municipal staff and identify opportunities to provide support and assistance with additional technical ability and increased contact. These efforts are essential to encourage planning and management to include trees, and to realize their significance as resources that help achieve other municipal goals. While core urban centers are limited in their ability to substantially increase their tree cover and the associated benefits, the edges of the communities where development is expanding is a prime opportunity for U&CF to engage communities, and to find the motivating factors and priorities that drives each community including among others:

- Connectivity and corridors
- Landscape functionality
- Stormwater management
- Air quality
- Human health
- Culture and character
- Right tree, right place.



Goals, Objectives, Strategies

Goal 1: Promote active and sustainable management to **conserve** trees and forests where people live, work and play.

Objective 1.1: Increase the number of communities with active local community forestry programs (managing/developing).

Strategy 1.1.1: Raise awareness levels of elected officials and policymakers on the benefits of urban trees and their management.

Strategy 1.1.2: Improve local governments' capability to write effective tree protection ordinances and policies.

Objective 1.2: Improve technical and professional capacity of tree-care professionals and the green industry.

Strategy 1.2.1: Provide workshops and training opportunities for tree wardens, municipal tree managers and professional arborists to increase their technical knowledge and ability.

Strategy 1.2.2: Support RITC's outreach efforts to promote current tree planting and maintenance best practices

Objective 1.3: Advance community urban tree inventory and planning capabilities.

Strategy 1.3.1: Provide information, training and technical support for community street tree inventories.

Strategy 1.3.2: Promote community-scale canopy studies to assess urban forest populations to determine their conditions, derived benefits, and values, as a basis to improve planning and management of the urban forest.

Goal 2: *Protect* trees and forests from threats (invasive, catastrophic, climate, etc.) through planning and response.

Objective 2.1: Develop disaster preparedness and threat response.

Strategy 2.1.1: Assist communities with incorporating trees into their emergency planning processes.

Strategy 2.1.2: Incorporate proactive planning for invasive species into municipal tree inventories and planning/management practices.

Objective 2.2: Assist communities with establishing tree planting goals and management plans including trees and urban forests as an energy-saving practice.

Strategy 2.2.1: Encourage communities to consider environmental and health equity when prioritizing tree planting projects.

Strategy 2.2.2: Facilitate strategic planting and maintenance of community trees for public benefits.

Goal 3: *Enhance* the public benefits of trees and forests through improved management practices.

Objective 3.1: Incorporate green infrastructure into municipal planning.

Strategy 3.1.1: Foster awareness that trees can help municipalities meet federal standards and requirements for air quality, stormwater management and water quality.

Strategy 3.1.2: Promote stormwater management practices using trees, natural systems and other green infrastructure measures.

Objective 3.2: Maximize program delivery and messaging effectiveness through partnerships and coordination with local, regional and federal partners.

Strategy 3.2.1: Provide education and support to RITC, TCUSA tree boards, tree non-profit groups, and other non-traditional partners.

Strategy 3.2.2: Continue to collaborate with regional initiatives and support in-state partners and agencies to develop consistent/shared messaging across programs and platforms.

Strategy 3.2.3: Engage with federal and state U&CF counterparts, attend meetings, share information, skills, and assistance.

State Lands Management

Program Description

DEM state land management is not one of the federal cooperative programs, however, the significance of these DEM properties warrants a brief discussion of this program in context with program delivery for the cooperative programs.

The over 40,000 acres designated as state lands is comprised of 29 management areas. The land is essentially under shared management/responsibility under DFE and DFW. Forest health silvicultural prescriptions are implemented when the situation warrants. Most of these types of harvests deal with white pine sawtimber and pulp. Harvests targeted to habitat maintenance/creation are conducted jointly with the Division of Fish and Wildlife addressing nesting season and general BMPs for wildlife. DFE also delivers prescribed burning through the Forest Fire Program and DFW assists with those burns.

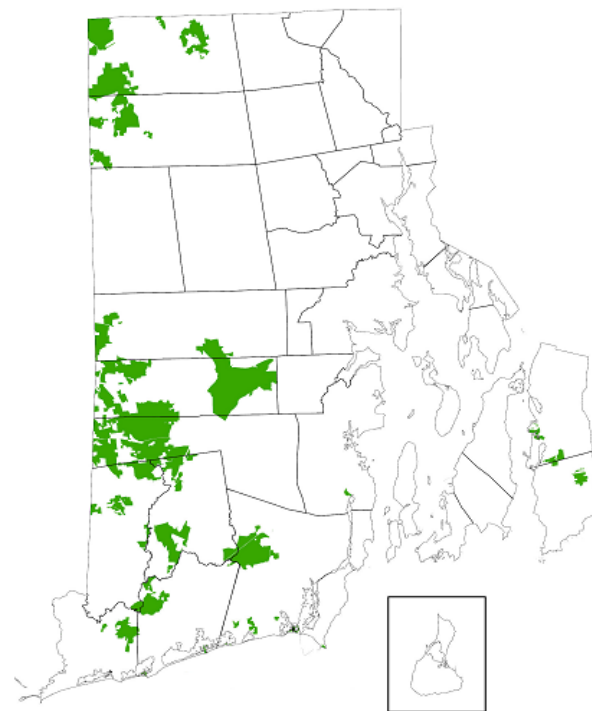
Specific responsibilities of the State Lands Forester include a wide range of duties such as recreational permitting, infrastructure maintenance, timber harvesting and general patrols of management areas.

Strategic Partnerships

RIDEM Division of Fish and Wildlife is the primary partner with DFE where land management is concerned, but land use by stakeholder groups are overseen by the Management Area Stewardship Committee, which is comprised of representation from five divisions of RIDEM (DFE, DFW, Parks, Legal, and Enforcement).

The committee is tasked with recreational permitting and oversees projects such as timber harvesting, trail work, clean-ups, and a vast array of volunteer events. As forest fragmentation continues and demand for recreational opportunities increases, the

committee's role in permit review is essential to manage access and use.



Land under RI DEM Management.

Arcadia	John L Curran
Big River	Killingly Pond
Black Farm	Long/ El Ponds
Black Hut	Newton Swamp
Buck Hill	Nicholas Farm
Burlingame	Rockville
Carolina	Round Top
Cocumcussoc	Sapowet
Diamond Hill	Simmons Mill Pond
DeCoppet	South Shore
Durfee	Succotash Marsh
Eight Rod Farm	Tillinghast
Galilee Bird Sanctuary	Wickaboxet
George Washington	Woody Hill
Great Swamp	

Due to the limited maintenance staffing, stakeholder groups are essential to coordinate events and conduct trail work/projects, some of the most active groups include:

- MOUs with:
 - [Appalachian Mountain Club](#)
 - [Rhody Rovers](#)
- Partners include:
 - [Audubon Society](#), [The Nature Conservancy](#), [University of Rhode Island](#), [RIFCO](#), [American Tree Farm](#)

Programmatic Capacity

With only one State Lands Forester long-term planning has been regulated to a back burner as history, long-term goals, and strategies are maintained within the heads of active staff. This methodology becomes more untenable in the face of fragmentation, climate change, staffing turnover, and the threats these changes present to high value habitats and forest.

With Rhode island's small size, its management areas are highly accessible to the public and management actions are highly visible. Prescribed fire and other management actions are publicized (signage and notification to abutting property) but the opportunities for effective public education and showcasing forest management strategies has been under-utilized. The development of demonstration sites for various practices, including management practices for deer browse or assisted species migration, sequential prescribed fire recovery sites, and habitat enhancement would be invaluable when communicating messaging regarding stewardship, forest health, fire management and even urban forests.

DFE State Lands staff face pressure by numerous stakeholder groups for access, the creation of unofficial trails with the resultant degradation, and a lack of enforcement.

Program Priorities

Oak mortality has become a serious concern throughout Rhode Island as outlined in the forest health section of this Action Plan. Salvage operations have been ongoing within state-owned management areas but with an excess of oak on the local markets, revenue from oak salvages has decreased considerably, which has

been an important source of funding for DFE and DFW. Future salvages may not be considered merchantable timber harvests as the oak continues to degrade past firewood grades.

WHAT ARE THE MAIN PRIORITIES HERE?

State-managed forest lands are an important component of program delivery for the cooperative programs. Location of management areas and their ease of access means that efforts undertaken on state land provides visibility and education to residents, including those who might not attend field days. State land priorities support the cooperative programs' priorities and can assist in the Programs' education and outreach.

Goals, Objectives, Strategies

Goal 1: *Protect* forest land from improper management practices and degradation from increasing recreational use.

Objective 1.1: Develop use and maintenance stewardship standards for harvesting and trail maintenance on state land.

Objective 1.2: Develop forest management plans for priority areas (high value/high use).

Objective 1.3: In partnership with cooperative programs, identify funding sources to aid development of management plans for high value/high use locations and demo sites.

Goal 2: *Enhance* and expand the use of state forest land for public education

Objective 2.1: Develop demo sites on state land to highlight the benefits of BMPs and forest management (e.g. harvesting, regeneration/restocking, deer browse, prescribed fire, etc.).

Objective 2.2: Deliver outreach and education to the public and wood operators, with partner organizations and cooperative programs.

APPENDIX A

National Priorities Five-Year Report, 2020

APPENDIX B

Land Use / Land Cover Mapping in Rhode Island

While moving to DOA/DEM/RIGIS 2011 Landuse/Landcover (LULC) data and DEM land records will make it easier to track change and assess changes in landuse over time as landcover data is updated in future satellite imagery, DFE is not incorporating this approach for the 2020 assessment. Future LULC updates will allow for assessing change but the differences in definitions and mapping between LULC and FIA do not allow this for 2020, as differences in approaches and priorities suggests that FIA, with its forest-centric definitions, incorporating canopy and site productivity, cannot directly correlate with land-use definitions based on apparent use. For example:

1. While the 2017 FIA forest land estimate of 368,000 acres shows an increase from 356,000 acres in 2007, that may be partly accounted for by the explanation of changes to the FIA protocols in the body of the assessment. Meanwhile, the LULC estimates 399,000 acres. The large increase, as identified under the LULC, cannot be assumed to indicate that forest land and habitat has drastically increased and is not at risk.
2. The mapping of ruderal forest as reported in the 2015 WAP by Photoscience using 2011 imagery showed 36.8 thousand acres. Much of this ruderal area would be defined as wildland urban interface (WUI), as seen in the i-Tree Landscape estimate of risk (pages 29 and 50) and is located in close proximity to highly populated areas or areas of higher demand. It is possible that at least some of this ruderal forest would not have met the stringent FIA definitions to include it in the forest land estimate, although it should now be captured in the Urban FIA protocol initiated in RI in 2015.

The Division of Fish and Wildlife used the LULC data in their [2015 Wildlife Action Plan](#):

- 687,360 acres of land (not including the bay or coastal salt ponds)[‡]
- In 2011, 399,000 acres were forested, with an additional ~7,800 acres as brushland, for a combined 407,000 acres considered as open land*
- equaling 56.6% forested land, or 59.2% open land

While the FIA estimates are based on acreages different from the LULC, FIA data provides percentages that have been and continue to be applied to describe and assess forest and timber land in RI. FIA data provides valuable information in:

- status and trends in forest area and location
- species, size, and health of trees
- total tree growth, mortality, and removals by harvest
- wood production and utilization rates by various products, and
- forest land ownership.

A perceived increase in forest land, whether from FIA estimates or LULC mapping, should not be interpreted to suggest that permanent land conversion is not a threat to forest land in RI, as other means of tracking and reporting show that permanent land conversion is continuing to advance.

What is important to remember is that the trends, challenges, and issues facing Rhode Island's forests continue, even if the definitions of the land under threat change.

[‡] Source: RIGIS 1997, 1:5000 scale mapping of state boundary and shoreline

*Source: RIGIS Land Use and Land Cover <http://www.rigis.org/datasets/land-use-and-land-cover-2011>

FIA DEFINITIONS

FIA definitions that are used to determine land use and acreage are specifically defined with dimensions, canopy cover, and in some cases site productivity potential, related specifically to trees, and are not solely descriptive in nature. Nationally applied in the FIA process, they are the basis for estimating the forest characteristics. The annualized process means that land is assessed and reassessed over time, capturing changes in use and natural progression, and able to be directly compared with other states and locations.

Cropland:

Land under cultivation within the last 24 months, including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, active Christmas tree plantations indicated by annual shearing, nurseries, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Forest land:

Land that has at least 10 percent crown cover by live tally trees of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence. To qualify, the area must be at least 1.0 acre in size and 120.0 feet wide. Forest land includes transition zones, such as areas between forest and nonforest lands that meet the minimal tree stocking/cover and forest areas adjacent to urban and built-up lands. Roadside, streamside, and shelterbelt strips of trees must have a width of at least 120 feet and continuous length of at least 363 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if they are less than 120 feet wide or less than an acre in size. Tree-covered areas in agricultural production settings, such as fruit orchards, or tree-covered areas in urban settings, such as city parks, are not considered forest land.

Nonforest land:

Land that does not support or has never supported, forests and lands formerly forested where use of timber management is precluded by development for other uses. Includes area used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, powerline clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet (36.6m) wide, and clearings, etc., more than one acre (0.4ha) in size, to qualify as nonforest land.

Nonstocked:

Forest land stocked with less than 10 percent of full stocking with all live trees. Examples are recently cutover areas or recently reverted agricultural fields.

Sawtimber:

Forest land stocked with at least 10 percent of full stocking with all live trees with half or more of such stocking in pole timber or sawtimber trees or both, and in which the stocking of sawtimber is at least equal to that of pole timber.

Timberland:

Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

LULC DESCRIPTION

The forest cover data is taken from the 2011 Statewide land use/landcover GIS data layer coded to a slightly modified Andersen Level III schema.

LULC Definitions

The coding schema for Land Cover/Land Use type is derived from the Anderson (modified) coding schema used by RIGIS in previous (1988 and 1995) land cover/land use data sets. It includes level 3 coding for Urbanized Developed areas (100 Codes); level 2 coding for agricultural (200 Codes), Forested lands (400 Codes), and Barren Lands (700 Codes); and level 1 coding for Brushland (300 Code), Open Water (500 Code), and Wetlands (600 Code).

Brushland (shrub and brush areas, reforestation) (#300):

Brushland is characterized by lots of shrubs and very few trees (< 50% canopy). It includes areas that are being reforested but the trees are not large or dense enough to be classified as forests. It also includes areas that are more permanently shrubby, such as heath areas, wild blueberries, or mountain laurel.

Cropland (tillable) (#220):

Cropland is generally tilled land used to grow row crops. There is usually evidence of intense land management. The land is often flat, well drained and the field boundaries are generally very well defined. This category also includes turf farms that grow sod. Associated facilities include barns and other outbuildings.

Forest Lands (#400):

Trees are classified as forests when the tree canopy covers at least 50% of the space when viewed from above on an aerial photograph. The three different categories depend upon the composition of deciduous vs. coniferous trees. On aerial photographs, most coniferous trees have conical shapes (except for pines) with dense needles and tight branching with dark spectral signatures, whereas deciduous trees have a more open or freeform shape with leaves (during the growing season) that give the tree a coarser texture or pattern and a looser or more open branching arrangement. Deciduous spectral signatures are generally lighter than coniferous signatures.

- Deciduous Forest (>80% hardwood) (#410)
- Coniferous Forest (>80% softwood) (#420)
- Mixed Forest (#430)

Idle Agriculture (abandoned fields and orchards) (#250):

When pasture, cropland and other agricultural uses have not been active for a few years, it is classified as idle agriculture. Often, early successional vegetation is seen growing around the edges and there is no evidence of any land or vegetation management. Eventually, it will become brushland.

Orchards, Groves, Nurseries (#230):

This category includes fruit orchards, greenhouses, plant nurseries, Christmas tree farms, vine crops (such as vineyards, strawberry and blueberry patches), and cranberry bogs (including sandy areas adjacent to the bogs that are used in the growing process). The orderly pattern of the vegetation generally indicates that one or more of these land uses is present. Associated facilities include barns, other outbuildings, and parking lots. Orchards and greenhouses are often symbolized on USGS topographic maps. Commercial lawn and garden centers that do not produce or grow the product will be considered Commercial.

Pasture (agricultural not suitable for tillage) (#210):

Pastureland is generally used for grazing of animals and for the growing of grasses for hay. It is often hilly, may have poor drainage or stoniness, and the field boundaries may be less defined than cropland. There may be scattered trees or shrubs in the field. Associated facilities include barns and other outbuildings.

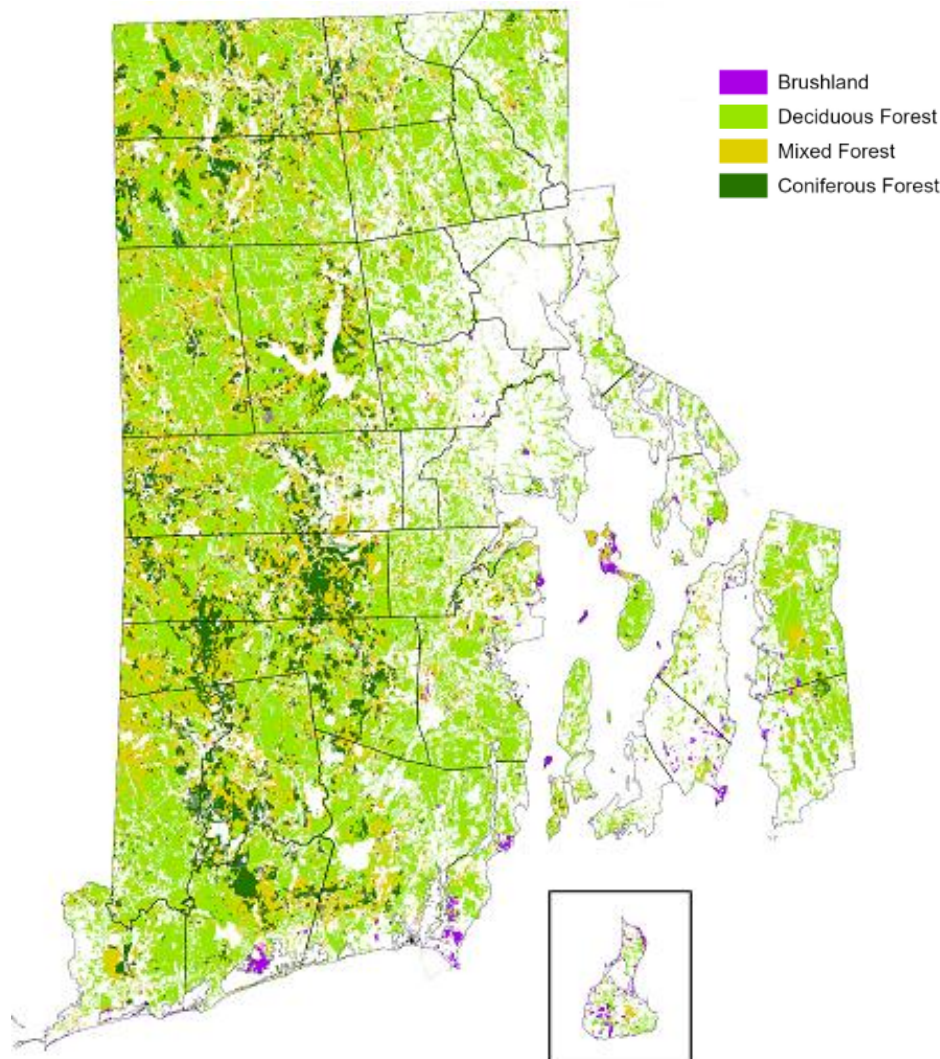
Vacant Land (#162):

Land is classified as vacant if it is abandoned land that isn't being used for any other land use, isn't being prepared for another use (see 750 Transitional Area below), and does not have enough tree growth to be

classified as forest or enough vegetation to be classified as brushland (300). It may include structures and indicates that the land was previously used for one of the urban categories

Type of Forest	Acres
DEM-protected forest	73,324
DEM owns by fee	47,384
Other (conservation easement, deed to development rights, recreation easement)	25,940
Other protected forest (by other land conservation entities)*	51,616
Total protected forest	124,940
Privately-owned, unprotected forest	274,060
FFOS forest	45,659
Total statewide forest	399,000

*Includes U.S. Fish & Wildlife Service, The Nature Conservancy, Audubon Society of RI, Municipal and Private Land Trusts, Municipal Governments, Private Homeowner Associations, Providence Water, and the URI W. Alton Jones Campus.



APPENDIX C

Rhode Island's Farm, Forest and Open Space (FFOS) Program

The Farm, Forest and Open Space ([RI Gen. Law § 44-27](#)) program allows Rhode Island landowners to have their property assessed at the current use, and not at development values. Properties enrolled in the program are assessed at a lower rate in exchange for ensuring that the property will not be developed for at least 15 years without paying a penalty, or Land Use Change Tax. Established in 1980, the law recognizes that it is, “in the public’s interest to prevent the forced conversion of farm, forest, and open space land to more intensive uses as the result of economic pressures caused by assessment for purposes of property taxation at values incompatible for the preservation as farm, forest, and open space land.” The FFOS law authorizes the RIDEM as the regulatory body governing both farm and forest land enrolled in the program, while the Open Space is administered by the city or town where the land is located. The FFOS has three classifications:

- **Farmland:** ornamental, vegetable and orchard crops, dairy and livestock (including forage crops) and the forest and wetlands associated with the property of at least 5 acres, actively devoted to agriculture.
 - Landowner must produce at least \$2,500/year in farm products (can be for personal consumption)
 - Landowner agrees to have a written Farm Conservation Plan on property, and follow Best Management Practices outlined therein, and will renew the plan every 10 years to stay in the program
- **Forest land:** Forest land of at least 10 acres bearing dense growth of trees including young regenerating forest and including wetlands, exclusive of house site
 - Landowner must have a Forest Stewardship or Management Plan at the time of application, and agrees to implement the plan and renew it every 10 years to stay in the program
- **Open Space:** undeveloped land (including farm or forest land) of at least 10 acres where the land serves to enhance agricultural or forest values, enhances wildlife habitat or protects ecosystem health
 - Classification based on soils; no management plan required

The funding methodology for land values used in the FFOS program was created in 1999 and is modeled on Connecticut and Massachusetts, while taking into consideration the higher cost of values for agricultural land in the state. The recommended value for lands classified as forest is currently \$115/acre. There are 571 landowners who participate, and over 45,549 acres enrolled and managed through the program. The Forest program is managed by the Forest Stewardship Coordinator who reviews plans, inspects properties every five years, and monitors compliance.

While the FFOS program works well as a tool to defer the conversion of land by reducing the property tax burden on Rhode Island landowners, it does little in the way of encouraging long-term conservation. The RI Land Use Change Tax only applies to a property classified as forest for the first 15 years in the program and property classified as a farm for the first 10 years in the program. After that timeframe, the statute states “...no tax shall be imposed by the provisions of the law.” It is also easy for a landowner to get out of the program. While a lien or legal hold is placed on properties enrolled in the program, sometimes they are overlooked.

Appendix D

Forest Carbon Data

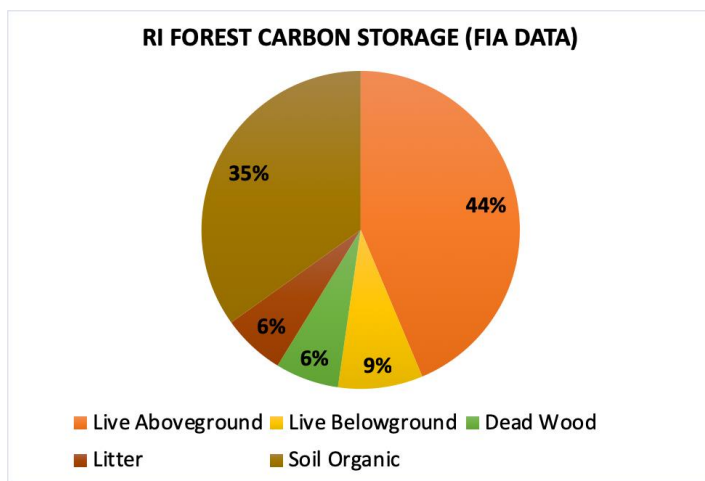
SOURCE: [*The Value of RI Forests*](#)

by the Rhode Island Forest Conservation Advisory Committee and the Rhode Island Tree Council

The [USFS Forest Inventory and Analysis](#) (FIA) program maintains a nationwide network of “continuous forest inventory” or periodic monitoring plots that provide data for an ongoing census of the nation’s forests. The forest carbon estimates provided in this section are from FIA data interpreted in consultation with experts from the US Forest Service’s Northern Research Station.

The URL data links provided through this summary are from the FIA program’s [EVALIDator Version 1.8.0.00](#) database.

RHODE ISLAND FOREST CARBON DENSITY (STORAGE) DATA



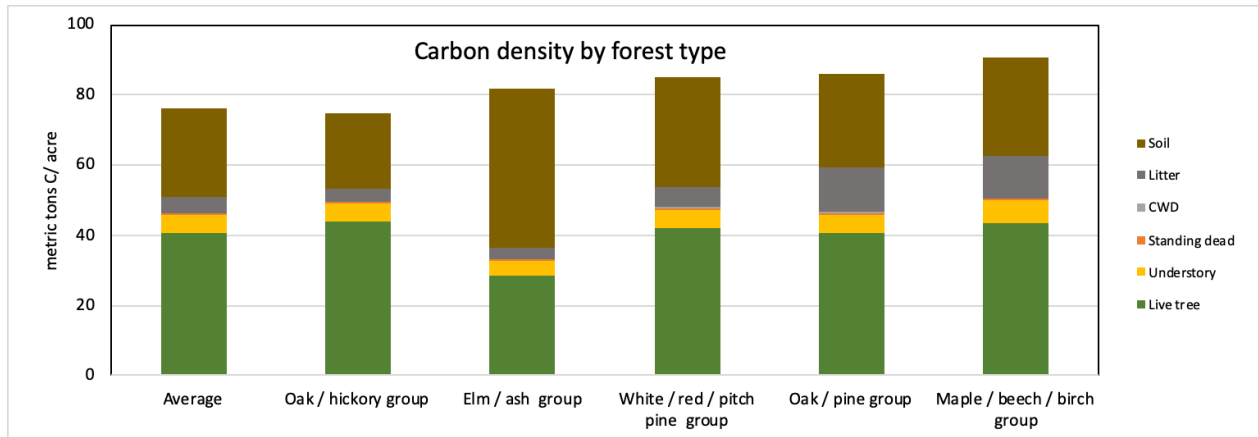
Since 2003, FIA has conducted an annual sampling inventory in Rhode Island and currently measures 14% of the sample plots each year. For the 2017 inventory, estimates of statistics such as volume and biomass were based on 222 plots sampled between 2011 and 2017 and reported in the yearly report: [Forests of Rhode Island, 2018](#).

FIA EVALIDator data links:

Total Acres	https://go.usa.gov/xy73s
All Carbon Pools	https://go.usa.gov/xyfAS
Live Aboveground	https://go.usa.gov/xyfHX
Live Belowground	https://go.usa.gov/xyfHR
Dead Wood	https://go.usa.gov/xyfHm
Leaf Litter	https://go.usa.gov/xyfHV
Soil	https://go.usa.gov/xyfH7

For greater statistical accuracy (lower standard deviation and tighter confidence intervals), estimates of forest carbon density and sequestration for different forest types include both FIA plots in Rhode Island and also plots in similar forest types in Connecticut.

STATISTICS FOR FOREST CARBON DENSITY (STORAGE) AMONG DIFFERENT FOREST TYPES



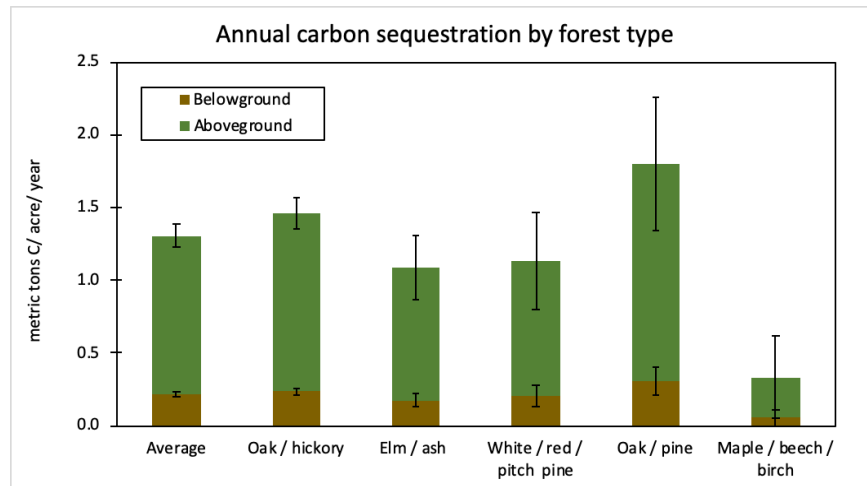
FOREST TYPE	# PLOTS	AVERAGE (mtC/ac)	STANDARD DEVIATION	95% CONFIDENCE INTERVAL (LOW) (mtC/ac)	95% CONFIDENCE INTERVAL (HIGH) (mtC/ac)
Total	443	76.2	3.2	73.0	79.4
Oak / hickory		74.8	5.7	69.1	80.5
Elm / ash		81.4	29.2	52.2	110.6
White / red / pitch pine		85.2	38.5	46.7	123.7
Oak / pine		85.8	39.7	46.1	125.5
Maple / beech / birch		90.8	38.1	52.7	128.9

mtC/ac = metric tons of carbon per acre

FIA EVALIDator data links

All Carbon Pools	https://go.usa.gov/xyfAc
Live Aboveground	https://go.usa.gov/xyfAa
Live Belowground	https://go.usa.gov/xyfAC
Dead Wood	https://go.usa.gov/xyfAY
Leaf Litter	https://go.usa.gov/xyfAg
Soil	https://go.usa.gov/xyfA4

STATISTICS FOR FOREST CARBON SEQUESTRATION AMONG DIFFERENT FOREST TYPES



FOREST TYPE	# PLOTS	AVERAGE (mtC/ac/yr)	STANDARD DEVIATION	95% CONFIDENCE INTERVAL (LOW) (mtC/ac/yr)	95% CONFIDENCE INTERVAL (HIGH) (mtC/ac/yr)
Total	397	1.31	0.09	1.22	1.40
Oak / hickory	276	1.46	0.13	1.33	1.59
Elm / ash	33	1.09	0.27	0.82	1.35
White / red / pitch pine	21	1.14	0.41	0.73	1.54
Oak / pine	19	1.8	0.55	1.24	2.35
Maple / beech / birch	30	0.33	0.33	0	0.67

mtC/ac/yr = metric tons of carbon per acre per year

FIA EVALIDator data links

Total Acres:

<https://go.usa.gov/xyEgT>

Average Annual Net Growth (Aboveground)

<https://go.usa.gov/xyEgE>

Average Annual Net Growth (Belowground)

<https://go.usa.gov/xyEgs>

Appendix E

Public Survey & Comments

Rhode Island 2020 Forest Action Plan Survey

Thank you for taking the Rhode Island Forest Action Plan Survey. The results of this survey will be considered in the development of priorities within the DEM Division of Forest Environment for policy, management and resource allocation decisions over the next 10 years.

Thank you again for your input!

Some context about you, so we can assess and compare responses.

Do you live in Rhode Island? *

- ☐ YES
- ☐ NO

Do you own one or more acres of forestland in Rhode Island? *

- ☐ YES
- ☐ NO

Do you belong to any of the following types of organizations? Please select all that apply. *

- ☐ Conservation Organization
- ☐ Fish & Game Club
- ☐ Land Trust
- ☐ Woodland Owners Association
- ☐ Outdoor Recreation Club
- ☐ None of the above

Does your work/employment involve natural resource management and/or conservation? *

- ☐ YES
- ☐ NO

Rhode Island's Forests

Why do you care about Rhode Island's forests? Please select all that apply. *

- ☐ General Interest/Enjoyment
- ☐ Lifestyle/Rural Character
- ☐ Hunting/Fishing
- ☐ Employed in/earn income from the forest products industry Hunting/Fishing
- ☐ Resource management (timber, non-timber forest products)
- ☐ Conservation
- ☐ Wildlife
- ☐ Recreation
- ☐ Ecosystem Services
- ☐ Value of urban trees
- ☐ Other





















There are many challenges to address in Rhode Island's forests. Please select your priority for each of the following 10 challenges over the next ten years.





















The challenges listed are in no particular order. *

	HIGH priority	MEDIUM Priority	LOW Priority	Not Sure
1. Forest ecosystem health and biodiversity issues: e.g. invasive species, deer browse, species and age diversity, threatened and endangered species, natural disturbance/ extreme weather.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
2. Loss of forestland and increasing forest fragmentation.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
3. Public values provided by forests: e.g. water, climate, carbon storage, forest products, recreation, education, culture.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
4. Public land management challenges: e.g. staffing and funding for planning, maintenance, etc.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
5. Challenges and opportunities facing private forest landowners.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
6. Climate change.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
7. Public awareness and support for funding for management of state forests and assistance to landowners and communities.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
8. Funding for effective forest planning and policy (e.g. land use planning, use of open space lands, regulations).	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
9. Land use conversion pressures on public and private forests.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
10. Urban forestry management capabilities in RI's communities.	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4

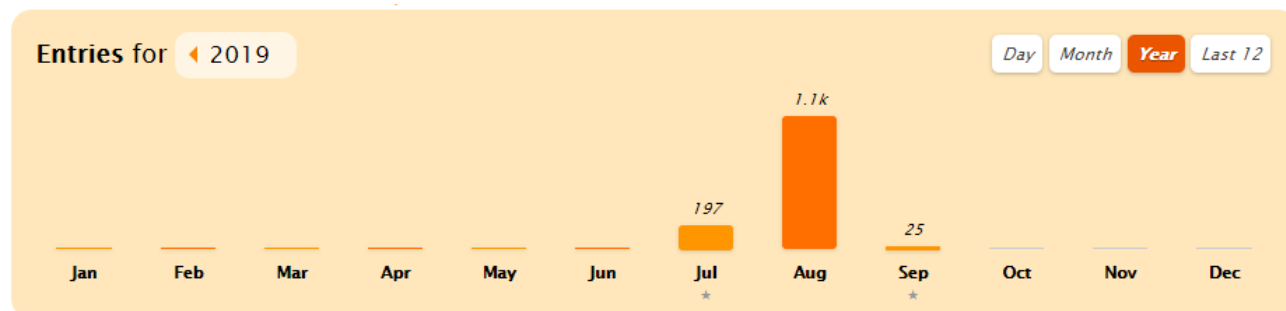
There many actions and activities in Rhode Island that impact its forests, from many sources. Indicate the importance of the 10 outcomes to the future of Rhode Island's forests.

The outcomes listed are in no particular order. *

	VERY Important	MODERATELY Important	NOT Important	Not Sure
1. Businesses, public decision makers, the forestry community, and the public have the information they need to make informed decisions about the ecological integrity and sustainability of the resource.	 1	 2	 3	 4
2. Contiguous blocks of forest and working lands remain intact to provide environmental benefits and ecosystem services.	 1	 2	 3	 4
3. Landowners, resource professionals and the public understand that forestlands contribute to the protection, availability and sustainability of high quality, cost-effective drinking water.	 1	 2	 3	 4
4. Healthy and sustainable urban & community forests support livable, desirable, and ecologically healthy communities.	 1	 2	 3	 4
5. Residents and visitors support and understand the value of Rhode Island's forests: the benefits they receive from the forest; and the relationship between a healthy environment and a healthy, vibrant forest-based and tourism economy.	 1	 2	 3	 4

6. Privately owned forest lands are supported to remain working lands for landowner, community and state benefits.	 1	 2	 3	 4
7. Rhode Island forests contribute to mitigation of global climate change, managed for resiliency to climate change with minimal adverse environmental and economic impacts.	 1	 2	 3	 4
8. Rhode Island's forests are able to support healthy and sustainable populations of native plants and animals.	 1	 2	 3	 4
9. Residents and local fire departments are prepared for wildfires through planning, implementation and response, reducing risks to people and structures; and protecting Rhode Island's forests and natural communities.	 1	 2	 3	 4
10. Rhode Island citizens and professionals are well prepared to respond to threats from invasive species; supporting adequate monitoring, response plans and suppression programs to minimize the impact of invasive plants, insects and diseases.	 1	 2	 3	 4

RESPONSE METRICS



Top Cities

	Providence	14.46%	187
	Wakefield	5.10%	66
	Warwick	4.02%	52
	Westerly	3.94%	51
	Cranston	3.17%	41
	North Kingstown	2.86%	37
	Charlestown	2.71%	35
	Newport	2.55%	33
	Pawtucket	2.47%	32
	Bristol	2.40%	31

Referrers

	ridem.wufoo.com	20.73%	268
	m.facebook.com	17.01%	220
	turnto10.com	6.19%	80
	www.facebook.com	3.94%	51
	www.ri.gov	3.17%	41
	com.google.android.gm	1.16%	15
	charlestowncitizens.org	1.31%	17



As previously noted, 67% (863) of the respondents expressed one or more concerns, in 1,940 comments ranging from a single word to lengthy statements. As shown in the word cloud on solar was the most repeated word, after forest(s) and tree(s) were removed.

Solar: Discussed first simply due to the myriad comments (296) with 22% of the respondents expressing concern about solar fields. In fact, 15% of the total comments were related to solar fields, with some respondents specifically expressing support for green energy but dismay at the lack of state and local regulation or guidance.

Although renewable energy is important, I feel there is a quick push to clear lands (or use farmland) to install large solar field installations. Instead of losing green space, efforts should be made to integrate solar into newly built and already existing hard surface, industrial sites.

Clear-cutting for solar sites is very wrong. It permanently destroys the forest carbon sink and animal habitats migration paths. It creates heat islands, and water runoff conditions similar to parking lots. Solar power capture belongs on rooftops, brownfields, and other accessible locations.

Clear-cutting trees for solar farms. There should be a program similar to Massachusetts which promotes solar development on already developed land such as landfills and unused parking lots.

Concerned about loss of forested land to solar installations. I applaud the use of solar but feel that rooftops, urban settings, brown-fields, etc., are better choices than destroying existing wildlife habitat.

I am concerned about the cutting down of forest land for temporary solar wind sites. We are hurting the environment more by allowing these solar farm companies to clear cut forest and degrade wetlands for renewable energy. Removing the trees that capture CO₂ out of the air for a solar site that will last 25-50 years and then have a degraded site that will never be as it once was does not make any sense and is a very nearsighted economic take on overall climate change.

While I support the expansion of solar energy, I feel that the current incentive policy that encourages the establishment of solar arrays on clear-cut forests rather than on already developed sites will expand the loss of our forests.

No solar or wind project sprawl should be allowed without first addressing the reuse of properties within each community that are abandoned, contaminated, underused, or other. Siting these projects should be based on a two prong goal – reducing the carbon footprint and protecting green spaces in RI.

Clearing acres of mature forest habitat for solar arrays. We are losing valuable habitat to solar farms. Better zoning restrictions needed for this type of development.

This survey is to check Rhode Islanders input for solar panels.

Recent solar projects seem to involve them being built on forested areas, or farms and other areas that can easily be conserved instead. While I like the idea of alternative energy and ending our reliance on fossil fuels, solar panels ought to be built on less desirable land, like abandoned industrial zones, closed landfills, even brownfield sites if they no longer pose a threat to any workers involved in the area.

We need stronger leadership on a state level on this issue and more tools and professional development for the folks who run the communities where the rampant deforestation is happening. The slick companies are coming in and writing ordinances to allow for all of this to happen.

State policies (such as energy independence via solar) have been adopted without consideration for the actual effects, nor with the incentives to place commercial scale solar on brown fields or rooftops. This is DIRECTLY creating a flood of applications for solar installations on pristine lands, and within designated wetland borders as well. The result is acres of deforestation which is not a good trade-off for even something as positive as Clean Energy.

Though I wholeheartedly support the growth of the wind and solar industries, I am very concerned about the clearing of forest for these purposes and hope that state and local governments will pass legislation to protect forest from such development and guide this business to use of brownfields and rooftops for this. Let's have weaning off fossil fuels that is harmless to the environment.

I am concerned that the state legislature has incentivized solar exploitation of our borderlands forest while failing to incentivize solar on brownfields, defunct shopping centers, etc. etc.---- areas away from our western forest. Forest loss for solar, promoted by state subsidies rather than incentives for rooftop solar.

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Actions, Policy & Legislation: Comments regarding perceived legislative needs and actions by DEM. Respondents are looking to the State to act decisively, to DEM to act to protect the natural resources, and also see DEM as responsible to protect forested land.

My concerns are health and sustainability and the State's role in promoting the conservation and management of our forest resources to maintain and improve our quality of life.

I am concerned our state is not doing enough to protect and conserve our forests and woodlands.

I have been told by Audubon of RI that there needs to be more assessment of various forested lands to rank them as to which are most critical for ecosystem services and wildlife. which are most critical to preserve?

I'm concerned that there is no overarching plan in place to prioritize contiguous forest land in RI, especially Western RI, over other uses. In particular, I am concerned about the incentives for large-scale solar developers to use forested lands instead of already developed areas.

I am very concerned about the steady loss of our state's forests due to the lack of open space and a lack of a comprehensive policy to protect and promote forests. The lack of ecological diversity and older growth also puts RI at risk of a dramatic loss from an epidemic. It seems that real estate interests win over forests every time. Relying on philanthropy is not a policy.

There are no DEM laws that protect the inland forests... the only DEM regulations that protect forests are those related to wetlands.

Unlike Rhode Island wetlands, forests have no standing in the language of RI law.

No clear vision from state agencies. Conflicting regulations. Courts don't uphold state agency recommendations.

Anything the voters approve to bring in resources for the State of RI's forests will go into the general fund and not towards the forests.

Need to protect forest and other open space through fee title purchase or development rights.

The lack of funding for most general conservation activities due to the high tax rates, low wage scale in this state high welfare budgets and the fact that it ranks 50th in attracting good paying jobs and businesses will prevent any real changes in RI.

Focus on funding when money is already grossly misappropriated in the state is a misdirection of effort.

Level of competent administrators in our elected representatives to take any real action that in any way will affect their re-election.

The state does not actively protect - State guide plan not upheld

State funding going to support Land Trust purchasing of forested land, yet little to no, enforcement of development and adherence to the associated forest management plans (e.g. Coventry).

RI's forest areas of high conservation concern should be mapped and protected from development. Forests are a resource actively providing value to our communities but are not acknowledged as such across many levels of planning. Currently, there are not enough incentives and regulations in place to conserve core forest areas and other forest areas of high value to wildlife, water quality, air quality, and other provisions of ecosystem services.

A tax system is needed to create additional incentives to keep woodlands intact. Private owners of undeveloped lands should not be taxed at all. However, owners who destroy natural ecosystems need to be charged a large fee to do this.

Forest protection regulations need more emphasis when considering future commercial residential development. Money and Jobs, Jobs, Jobs, should not be the deciding factor in land use policy.

Farmland abandonment should involve mandatory set-aside for reversion to forest or lowland. House lots over ½ acre should include non-lawn requirements.

The lack of leadership by the State legislature is resulting in the continued loss of forest land through fragmentation, parcelization and conversion to other more intensive uses which threatens clean water, clean air, wildlife habitat, conservation biodiversity, our economy and public health.

RI has no enforceable policies or programs to conserve forests, other than a small forest acquisition program, despite goals and policies in State Guide Plans that say RI should maintain forests.

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DFE and DEM capacity and funding: Some respondents recognize that both staffing and funding are needed to address their management concerns, and planning or information needs. To meet the many valid needs identified here and in other themes requires a commitment from the State to maintain sufficient staffing capacity. Otherwise, valid resource management needs remain unmet, planning capabilities are inadequate, and the not-entirely-unreasonable public expectations remain unaddressed.

Lack of financial support to sustain forest habitat.

I don't know how well the responsible departments, officials, employees are funded to do an adequate job.

Lack of DEM staff to achieve the mission.

Lack of DEM support for forest lands (staff reductions).

Staff for environmental programs so small they can only react to problem.

Our forested areas in RI need to be taken care of. SO MANY dead trees and brush on the forest floor. Terrible wildfire hazard. The State needs to hire many more DEM employees to address these issues.

DEM needs more resources to maintain the forests.

Seems to be no plan in RI as to how to manage forests.

Preservation of existing forest lands for recreational and wildlife purposes. As development claims remaining private woodlands and lots, the state preserves become even more important

Building of an Office Building by DEM on wetlands and a beautiful valued area of Arcadia -Browning Mill Pond. DEM should follow what would only be allowed by an individual. They are completely ignoring that both towns do not want it there. There are plenty of other better places.

I notice that the management of the state forest is very well done, and I want it to continue for the benefit of myself, my family and the community at large.

The lack of proper management by the State of our Woodlands.

Maintenance of state-owned lands could be improved. Little resources dedicated to preserving what we have.

Lack of state resources for managing forests and trees.

RI's forest managers (including DEM) need more funding for active forest management.

I hope the State DEM and local land trusts can continue to acquire open space, including forests.

No resources available for the management of state-owned forests.

I think much of my concerns would be rectified by adequate staffing of personnel to protect and oversee our forests.

Lack of forest stewardship on state lands and many land trusts.

Lack of funding and resources to adequately manage public forests (both urban and rural), assist private landowners, and increase the pace and scale of forest conservation efforts

Lack of management in state management areas.

There needs to be more funding in the state budget for environmental purposes. RIDEM has been neglected for far too long, especially by the current administration. We need to start protecting what is left that is not developed in this state.

Need to increase management of existing forests.

Lack of climate change leadership in DEM Forest Environment (not enough trained staff).

On a brighter note, I do think RIDEM does a great job trying to preserve as much land as possible.

Lack of program support to sustain forest habitat.

DEM does not have enough staff to do what they know how to do best. I am very sorry about that. What can I do to help?

###

Fragmentation & Development: Fragmentation (42 mentions), development (294) and solar were closely connected in the comments by many respondents. Concerns about the impact of development was tied directly to fragmentation and wildlife habitat. Numerous comments identified needs for planning to manage development and prioritize areas of high environmental value, and for enforcing existing planning requirements.

Forest conservation should be embedded and enforced in local and state planning processes to minimize the amount of forest fragmentation caused by human development.

Concerned about the continuing loss and fragmentation of forest land that has negative impacts to the multiple benefits of RI's forests

Concerned about not enough forest acreage being preserved and protected from development.

Concerned about continued urbanization that reduces forested lands

Continued forest loss and fragmentation for short-term interests at a much greater long-term cost.

Encroachment by unregulated development that fragments species habitats.

Forest corridors are important for wildlife and quality of life. Fragmenting and or loss of forest land will be devastating for many species, animal and plant.

Fragmentation will limit the woodland's ability to adapt to changing climate, recover from insect damage and resist invasive. Protected parcels should be as large and connected as possible.

Fragmentation. The smaller our blocks of forest become, the less area-sensitive plants and animals they can accommodate. Additionally, the less large, intact forest we have, the greater the impact of numerous other threats to forest ecosystems (e.g. the proliferation of invasive and opportunistic native species that directly threaten or compete with at-risk species; overuse overharvesting, trampling or harassment of species, the introduction of diseases and novel pests because nowhere is inaccessible or remote enough to have little or no foot traffic; and on and on...).

Encroachment disturbances (physical, chemical, noise, light)

Maintaining natural, connected super-blocks that are unimpeded by roads for habitat and reforestation, as well as allowing solitude without sounds of cars, etc.

Highest possible use (economic) is often development. This threatens forest preservation.

I am concerned forest conservation is not considered a priority relative to generally unplanned development and short-term economic gain

I am concerned about the lack of policies and political priority to protect trees in urban and rural areas that are being threatened due to rapid development.

I'm concerned that poorly considered and unplanned development, in concert with our practice of zoning and land use planning done on a town by town basis (rather than statewide) is resulting in fragmentation of our forests and small, isolated pockets of forest land rather than large continuous tracts of forest land.

Loss of habitat including the pine forest extending from western RI into CT, the loss of meadows with native flora, and of marshland, and the associated losses of natural protections against flooding and erosion embodied by the interlocking roots systems of the forests, the loss of oxygen, and the unnecessary contribution to global warming as result of the release of carbon as by-product of deforestation.

Loss of habitat protection and benefits for the entire earth (including carbon sequestration, oxygen production, storm abatement, earth cooling temperature mediation).

Main concern: our natural landscapes including forests continue to diminish at the detriment of RI residents.

Loss of forests to residential, commercial, industrial development, including renewable energy development

Need to not only protect forests but also build more contiguous protected areas for ecosystem flourish and wildlife corridors.

Protection of forests from habitat loss and fragmentation so they may continue to provide ecosystem services, and simply for their Existence Value.

Loss of contiguous woodland for animal migration.

Contiguous lands should be preserved for habitat plus as migratory routes.

Can we conserve enough forested property to allow for connectivity for wildlife or are we only conserving small areas that are unconnected?

Maintaining open space.

Not enough corridors. Land is fragmented and where the animals can cross there are no speed bumps or warning signs to allow people to slow down. Maybe even incentivizing people to slow down with signs of the animals that are present and need to cross.

Forests provide critical habitat for wildlife. Less preserved space makes for more frequent encounters with wildlife in populated areas.

Fragmentation of forests and loss of wildlife habitat, especially large complexes of upland and wetland areas.

Development and the lack of funds to preserve intact forests.

Loss of forest will further degrade the habitat, carbon capture, cooling, airquality and ability to mitigate climatechange.

RI does not have a strategy for ensuring protected habitat corridors. We take for granted forest land that is in private ownership.

RI's forests are becoming increasingly fragmented and therefore less able to support wildlife and provide other ecosystem services.

RI lacks strength in legislation and in administrative procedures to partner with local communities to PROTECT, by mutual agreement, appropriate swaths of forested acreage. For example: it is pointless to have a Natural Heritage designation, or a Heritage Corridor named if that is meaningless to both the Towns and lacks review when development proposals arise.

I am concerned that the DEM Wildlife Action Plan, which should be the decisive reference in all local and statewide solar siting regulation is ignored. Too many town planners and town planning boards, and even conservation commissions, are totally unaware, ignorant of, the WAP and its accompanying Conservation Opportunity Areas mapping.

Fragmentation of habitat - a need for a comprehensive prioritization of sites for protection that will provide corridors connectivity for wildlife and also migration pathways for entire ecosystems as climatechange influences the distribution of certain species.

###

Forest Health, Invasive Plants, Pests & Disease: Invasives, whether plants or pests were a common concern. The recent Gypsy moth infestation is still fresh in some people's minds. For some, the impact on ecosystem health was the main issue. For others, "caterpillars" or "invasives" said it all.

The invasive vegetation across Rhode Island is becoming more and more prevalent each year... I think the State needs to partner more with the private sector and get a handle on this.

Alteration of forest ecosystems by invasive plants pathogens.

Beetle infestations seem to be a problem in RI.

Concerned with too many dead trees from Invasive species- Gypsy moth.

Destruction through invasive species: emerald ash borer, woolly adelgid, bittersweet, knotweed.

Gypsy moths have killed many of our oaks. Other invasive pests such as the Emerald Ash Borer and the Asian Long-Horned beetle seemed to be poised to make an appearance any day!

Invasive management around the state seems to be lacking a great deal.

Infestation of pests and invasive plants that contribute to creating stress on trees and plants that ultimately contribute to deforestation.

Oak mortality causing invasive succession.

RI needs to make an official invasive species list and a law that nurseries are not allowed to sell invasive plants.

Nurseries in RI are still selling noxious invasive plants. Other New England states have enacted legislation to prohibit the sale or transfer of *Euonymus alatus* (burning bush), various *Berberis* (barberry), *Ligustrum* (privet) etc. RI needs to follow suit.

Invasive species encroachment, especially around the edges of woodlands, both private and state-owned. With increased development comes an increase in the edges threatened by invasive plant species, and with time, these invasive species, at least some of them, will move into the interior of our woodlands. I wish there were the money to manage the Japanese Barberry I frequently see deep in the woods!

Monitor and control disease and invasive insect damage.

###

Urban Forestry: Trees in urban areas need to be managed and planned, and preservation of trees and green space were valued.

Each town in RI should offer the same type of protection for its trees, via ordinance, from development.

It seems like a social norm that people cut down trees on their properties for the view, for safety reasons, etc. I live in a city and just in the 3 years I've been there trees have been cut down on adjacent properties with no replacement. There's less shade, and the greenery was nice to look at. I know this is true outside the city as well. How can we change this behavior?

Less, and less green spaces within urban settings. Houses with yards turned into multi family or commercial properties with paved lots.

Many of RI's cities and towns do not have any regulations about the removal of urban trees. Homeowners in my neighborhood have removed many old trees not because they were diseased but because the homeowner didn't like to deal with the leaves in the fall...

Need small suburban tree parks.

Need to plant more urban trees to ease air pollution and enhance living in urban areas.

New housing developments clear cut trees then replant small ones. How about planning the houses better and leaving lots of mature trees for enjoyment.

Providing natural shade to cool urban areas.

There are not enough urban greenspaces - trees, parks, forests etc.

Towns do not have enough acres set aside for wildlife. Small sections of greenspace when developing is not enough for the ecosystem.

Urban forests are poorly managed. Most cities and towns lack forestry programs while private sector tree planting and care is haphazardly and improperly applied.

Urban forests in places like North Kingstown are neglected. Roadside trees die and don't get replaced.

More funding and resources is needed for urban forestry programs to increase quality of life for our urban residents.

Lack of forcible legal protections on forests and trees specifically against various types of development.

Lack of a master plan for protection and growth.

Need more urban street trees - should be prioritized when considering projects for repaving renovation rather than being included as an afterthought.

Replacing large urban trees with small trees that will take many years to grow to provide the same ecosystem services as the trees they replace. Would like to see additional planting of trees in urban areas.

I feel the state and local city town governments do not preserve the forests well. Cranston in particular seems driven to develop every square inch of forested land.

Allowing forested areas to be developed for commercial and industrial uses rather than prioritizing development in urban areas that are already zoned for these uses and currently unused.

I am extremely concerned about the lack of funding for urban forests. Even those towns aware enough to want more trees have no support. Given the high density population of many towns, it is disconcerting to see long stretches of road without any trees at all. An easy solution would be to let the highway grass regions grow back naturally -- we shouldn't be spending precious budget funds on planting and cutting grass along highways. In towns, the state should provide steady support for tree planting, not grants given only to a few each year -- as if planting trees were a privilege as opposed to a civic duty.

How hard it is to get a street tree planted in Providence (our business has two ugly, dead trees now in tree wells). For all the talk about how valuable they are the city is very slow to commit any time money

Lack of forest and tree canopy in urban and suburban areas in RI

People cutting down trees on their property, particularly in urban areas.

Urban sprawl and poor land management (Lack of comprehensive plan or enforcement of comprehensive plan). For example - Citizen bank campus in Johnston involved clearing of forest and BJ's off of Atwood Avenue. Strive to find alternative sites where less clearing is needed. Reckless (short-term) behavior of RI planners and elected officials in regard to forests.

We need more trees in urban environments to lower temperatures and increase visual appeal.

More resources need to be put into the urban forest so we can restore the tree canopy and make a more healthy environment for all.

Development regulations in rural communities are poorly thought out, disorganized, or not enforced by the municipalities. Rules are too subjective to change ... to create any real, long term protections for forests.

We need to focus on investment in RI's urban areas to keep them healthy, attractive places to live.

Currently, RI municipalities discourage volunteer participation in urban forest support activities such as those RI Tree Council provides. Apparently volunteers are viewed as threats to public employees. There is more than enough work to go around. Some persuasion is needed to overcome this short-sighted resistance.

Depletion of healthy urban forestation to reduce the impact of heat island and aesthetic of nature.

I've never heard the term urban forestry before, but if it means having green spaces in cities I am absolutely for it. Blackstone boulevard was the only green space I had access to as a child in Woodlawn Pawtucket. That and the areas by the Blackstone river that had been abandoned due to the polluted water. Now that the bay and the river are cleaner, the land is being built on. Why wasn't this land made into actual parks?

lack of comprehensive plans to plant replant forests urban leading to forest fragmentation

Lack of permeable surfaces (streets, sidewalks, parking lots) limits urban forestry.

Stricter policies are needed to minimize impervious surface to free up space for tree planting sites.

Too few Urban trees in the less well to do neighborhoods in Providence.

Town planners and natural resource managers should have more education and awareness of the effects of invasive species on our trees and forests. It should be a priority to stop the spread of invasive vine species which are overwhelming our trees by climbing, shading, weighing down, girdling, strangling and killing them.

We need more trees in our urban areas to help cool our cities and provide natural areas for all RI citizens.

###

Water: Water quality, both for drinking and for environmental and wildlife health, were noted concerns.

Clearing that results in erosion and impacted waters.

I have heard a rumor that buffers along streams are under consideration for shrinking. Terrible idea as our watersheds are being destroyed by climate change. Cold water ecologies are shrinking from the top down.

Keep invasive plants weeds out of our ponds and lakes.

Need to protect forests to protect ground water.

Protecting wetlands.

That we don't take care of our ponds and rivers. Some need some dredging that would have a positive impact on fish and wildlife.

The native freshwater fisheries need serious help. Surrounding areas have substantially healthier fisheries.

Woodlands need better protections against Urban and Solar sprawl. Upcoming amendments to freshwater wetlands act should have better ties to upland resources.

Contamination of rivers and streams due septic systems, industrial waste, over use of fertilizers and chemicals on lawns and gardens.

Not enough oversight on development too close to our drinking water supply.

Protection of vernal pool amphibians only focus on breeding ponds, need to protect 400 m wide buffer in upland forests.

That the fish ladder at Breakheart Pond is in total disrepair and needs to be rebuilt or replaced.

Waterquality as RI loses more forested habitat that provides buffers to our swamps and other wetlands.

Most of RI gets drinking water from the Scituate Reservoir. Adjacent forest land buffers pollution and helps preserve the quality of drinking water.

Areas along stream rivers, ponds lakes and wetlands should have a minimum of 20 to 40 feet of woods left adjacent to these bodies of water to help reduce unwanted sediments into these areas. Also having adequate trees near streams, rivers and wetlands help reduce over heating of these environments and to the invertebrates that live in these environments...

###

Fire & Risk: Many respondents noted the amount of oak mortality and the increase in risk of wildfires and tree failures or breakage.

I believe you need to get in there and clear-cut the dead standing trees in the Arcadia area from gypsy moths before a lot of those trees fall on cars as they rot over the years.

Current management of dead or dying trees connected to insect destruction. To create growing space for new tree growth and reduce risk of wildfire brush fires.

Dead trees and over accumulation of ground and ladder fuels. Oversupply of dead timber stands. I'll take care of it. Call me.

Manage older vulnerable trees for thinning prior to disaster or high wind events.

Die off of oaks, spruce. The forests are being decimated by pathogens and are losing biodiversity and resiliency. This seemed to catch the state by surprise and there was seemingly no effort to deal with them. I'm concerned in this regard about forest fires and downed trees on wires and roads.

I am concerned that there has been little to no action to remove gypsy moth kill trees especially in south county, Burlingame hunting area is loaded with them for example. Many dead rotting branches (widowmakers). I imagine they are becoming a fire hazard. Additionally they make great poles for poison ivy to climb.

... the fire roads such as Bald Hill Rd are not being maintained. In the event of a forest fire, there is no way to get fire trucks to the fire.

I hike daily in the Black Hut area in Burrillville. The last several years, between Gypsy moth caterpillars, droughts and the insects has caused a lot of trees to die. Definitely a safety concern on windy days for falling trees and limbs. With the right weather conditions I feel that the threat of fire is much greater than in years past with such a layer of a fuel source of dead timber on the ground.

I'm concerned about the number of trees that have been affected by gypsy moths and the invasive beetle. With a high acreage of tree mortality, it puts the state at an increased risk of wildfire and an increased risk of critical infrastructure failure if trees fall on power lines or along emergency evacuation routes.

The amount of dead trees and downed trees and their associated fire load.

Invasive species and loss of habitat and fragmentation, potential for forest fires due to increased fuel from damaged timber.

Potential for fire due to build up on forest floor.

My main concern has to do with the death of 1000s of oak trees from the caterpillar deforestation. I worry about trees falling on people and property, the lack of acorns for the deer, and just how terrible it looks.

Need to increase understanding of historical significance of fire and other disturbance patterns. Is there potential to learn from prescribed burning programs on west coast?

RI is doing nothing to clear the forest floor of dead trees and is potentially setting itself up for a major forest fire, the kind we see in California. We had one in the early '50 in Exeter and Coventry. Just drive around the Scituate Reservoir? Why can't we have a CCC program like those of the '30s when city kids were taken out of urban areas to work, learn and appreciate the forests in our state?

Safe removal of dead trees.

The current high level of dead and dying trees coupled with the unchecked growth of brush and small trees leaves the state in significant danger of an uncontrolled wildfire with probable impingement and damage to many rural and suburban homes.

The lack of deadfall cleanup creates potential for there to be a large-scale forest fire in the arcadia management area.

Vulnerability to wildfires.

We need to do more habitat enhancement. Let it be clear-cut or control burns. We need new growth.

...I live near Nature Conservancy land, and they manage their property in such a way that it is going to be vulnerable to a BIG forest fire if one starts.

Wildfire potential.

Although RI is not a state that is typically in danger of wildfires, the gypsomoth infestation of the last few years has left huge swaths of dead standing timber and tons of fuel on the ground.

Bring down half of dead trees for fire prevention.

EAB destruction and death of ash trees posing hazardous environments in parks and in urban areas.

Gypsy moths have done terrible damage to trees in many parts of the state. Lots of standing firewood that poses dangerous conditions along highways.

Forest fire management.

I don't see enough fire breaks in our forests, to prevent the spread of a large fire. When we do put breaks in,

why can't we plant lanes of pollinator flora to help balance the ecosystem?

If there are many, many blown down trees I assume this will add potential fuel for any forest fire.

The number of dead trees along South County roads is a real problem – to the tourist economy, to storm related power outages and to public safety.

Protection of forest from fires.

Some of the bridges in Arcadia will not support the weight of fire trucks. I know some bridges were replaced, so maybe this is not a big a concern.

Standing dead wood. Fire Hazards.

We should implement control burns to keep fields and open spaces free from overgrowth

With so many dead trees, forests can pose a wildfire hazard. Not many Rhode Islanders are fire-savvy. For example, cigarettes go out the car windows and land along the roadside where dry tree needles and leaves gather. Fireworks go off all summer long!

Wondering if deadfall is being cleared. RI had some devastating forest fires in the 1930s.

Will wildfire become more frequent as the urban wildland interface grows, as the climate warms, and organic matter builds up due to fire suppression to protect spreading homes?

As a Firefighter, access to forest land is important. Clear road trails and DEM's forestry program need to be high priorities.

Dead trees standing, with possibilities of brush fires, or trees falling on power lines or people.

Need preventative forestry wildfire breaks.

Safety of community from falling dead trees.

Potential danger of wildfires to homes, wildlife and of course, people.

###

Deer & Wildlife: The importance of wildlife (179) habitat was a common comment, but overgrazing by deer (36) on forest understory plants was a noted concern for forest health.

I am concerned about deer pressure on the under story of forests. Must do something about the high deer population.

I'd like to see more wildlife surveys done in our state managed forests.

Concerned about all native pollinators.

If you need to control some populations (e.g. deer) get predators into these forests.

RIDEM refusal to extend the deer season to help alleviate the browsing that prevents regeneration after a log harvest.

Overabundant deer.

Protection and maintenance of forests so they may continue to support sustainable populations of all native wildlife, both game and non-game.

At a F&W regulations meeting a prominent woodland group complained about the overabundance of deer on their land, but they didn't allow or have a way to qualify and allow hunters to help with the problem and were seeking financial assistance, which seems extremely inefficient when we have willing and able hunters who would pay for the license and tags, and help out too. Can we create a way to connect our hunters to landowners whose forests would benefit from browse reduction, which would benefit both groups?

Alteration of forest ecosystems by overpopulation of deer.

Deer overpopulation affecting forest regeneration.

In addition to preserving existing forest, there needs to be more effort put into reclaiming unused cleared land (e.g. abandoned farms) for early successional forest to encourage the rebound of the New England Cottontail rabbit.

Limited deer hunting, not enough hunting to control the herd

RIDEM refusal to issue deer damage permits to forest owners. Trees are an agricultural product as well as corn and tomatoes. The difference is the length of time between harvests. One year for corn and alfalfa, ten or twelve years forest products

Maintain and protect wildlife corridors.

The overpopulation of deer are eating everything in sight. Our forests are being denuded of their understory plants.

Unregulated outdoor lighting (light pollution) affects wildlife habitats. Care should be taken to use the right amount of proper lighting on properties and communities close to our forest land, and throughout the state. Especially concerning is the proliferation of LED technology, which emits strongly in the shorter wavelengths, known to disrupt biological processes.

Forest age diversity. Some species such as American woodcock and Ruffed Grouse depend on younger forests. I am concerned that there is not enough habitat for these species.

our native wildlife is being pushed further and further out of their natural home habitat and then the uneducated are scared, bothered by or uneducated when these animals show up in their backyard.

Deer - the automobile accidents, tick borne disease, & damage from over browsing are all concerns enough to warrant population management strategies.

Deer and other animals preventing forest regeneration.

Deer browse and invasive species.

Deer overbrowse.

If deer are a threat to forest health, allow more hunting; increase bag limit for either gender, allow sale of venison.

RIDEM foresters are trying to manage forests to keep deer hunters happy, not with the goal of a vibrant, healthy forest. More than 15 deer per square mile does not make for a healthy forest.

The detrimental effect of the excessive deer population on our forested lands. DEM F&W managing deer to the maximum carrying capacity, with no regard to the environmental effects of over browse by high deer numbers.

The overpopulation of deer which is causing deforestation and an eco-imbalance with the wildlife population.

Overpopulation of deer decimating native vegetation

There are many species of wildlife that depend on contiguous stands of forest for their survival. It would be a shame to lose these species in the future.

###

Private Land Management: Comments regarding the Farm, Forest and Open Spaces Act (FFOS) or the need for assistance to maintain working lands, shows the significance of private land management and ownership concerns.

Active management by private and public forest owners is essential to passing down healthy forests to future generations.

... the current strategy is rapidly progressing to be insufficient at best to manage Rhode Island's forests. Education, tax relief and support are all the usual ways of dealing with this problem. But they pale in comparison to large-scale solar farm companies or housing developments dangling bucketloads of money in front of an aging landowner population tired of managing their lands. The younger generation's care and connection of their parent's woodlot is not as strong as the older generation. Time and time again, I've personally seen the carving up of agricultural land, forest land for housing and solar fields. The money is just too great to ignore. However ... I believe partnerships are key to changing the eventual trajectory of our forests. And I believe that more has to be done.

Farm, Forest, Open Space program is a good start, but promoting forest management through outreach at the state level should be a priority.

I found the legislation that was introduced by the Audubon Society in the past legislative session very troubling. As a land owner I maintain and pay taxes on my forestry property in compliance with existing state DEM regulations. I feel any more impingement on control of my property is an overstep by the government. So as I respect rules to protect forest open space, it is my property. If the state is interested in keeping more land undeveloped, it is their responsibility to purchase the land, not impose restrictions on land that is privately owned.

I own 10 acres of undeveloped forested land and I never know where to go to find out what resources would be available to help maintain it. Are there best practices that landowners can follow?

I am concerned that the majority of open forest land that is not owned by the state will be slowly chipped away at. It is a RI landmark and is what makes RI special

Land owners selling off part of their property to developers because they need the money.

Provide homeowners of smaller forested land resources and management help.

Forested areas are getting smaller and smaller.

I have found there is assistance for large property owners, but none for homeowners who wish to clear invasive & plant appropriate, beneficial, native species. A program offering small grants would be a huge help.

Lack of careful integration of forestry and farm programs for management of land.

Large family tracts need to be supported in any way that allows private ownership of intact parcels. Income production and tax support. The next generation of Rhode Islanders can have trouble when grandparents die.

We're losing forested land. I pay big taxes on my land and I understand why people subdivide.

Many forest land owners own small parcels, and are not eligible for FFOS, therefore do not receive incentives to manage their forest. This should be especially emphasized on parcels that are contiguous with well-managed forest land.

I'm keeping my land as native and untouched as possible for the benefit of wildlife (lots of development around me). Are there any resources for that as well?

Lack of info about the FFOS.

Lack of outreach forest management programs for landowners. There seems to be no coordinated outreach efforts to work with local forest. Also, outreach to public about the values of forests.

Landowners are being told they can't cut trees or clear land if they want to. The reason should be irrelevant.

I have a forest plan and I am trying to follow it and DEM is working against the stated aims of my forest plan by putting up obstacles to its activities. Primarily by not allowing implementation of path creation by denying the harvesting of trees. Making land ownership cost effective, productive, and affordable

Need tax breaks for forest preservation.

Source of income for farm program should be broadened to be more inclusive of non-consumptive uses.

Funds and incentives for property owners to maintain raw land.

Lack of stewardship by landowners.

###

Climate change: Respondants had questions and concerns about the impact of climate change (92) and the need to maintain forests to help mitigate the impacts.

In 50 years, the climate here will be similar to the present climate in the Carolinas. How will climate change damage and alter our forests?

Adaptability and vulnerability to climate change! We need to think of forests as a climate strategy.

Between pests, pathogens, and climate change, many of the component tree species are in steep decline. What trees will be left to form the forests of the future? Those forests will certainly be very different.

Climate change puts all forests at risk, but I am particularly concerned about the northwestern pine forest being fragmented by landowner development, it's so vulnerable already.

Climate change, especially increasing air and water temperatures, aiding in the spread of invasive, pests, and diseases.

Climate emergency impacts - sea level, wind, degradation of soil, temperature conditions for growth

Devastating impact of climate change on health of our forests.

I'm concerned that this entire state might be underwater in 50 years and nobody of prominence and authority seems to share my concern. Cities and towns are still building along the waterfront with no mention of climate crisis.

I'm passionate about climate change and think the state needs to much more aggressively expand renewable energy AND protect forests.

Climate change will inevitably negatively impact forest land, which will, in turn, speed up the worsening of climate change.

I'm concerned about loss of forested lands and the impact that may have on carbon sequestration and climatechange issues generally.

Manmade climate change is a hoax.

With impending climate change, what are we doing to reforest areas of RI? Further, what can be done by civilians to help, and is there public outreach available?

Climate change - we need forests to partially offset rising temperatures, help to preserve precious groundwater resources and wildlife.

###

Education/Knowledge: Education, or the lack thereof, received some attention as a way to develop support and improvement for forests.

I feel that homeowners need much more education and support regarding the importance of growing and maintaining the urban forest for purposes of mitigating climate change.

Perhaps environmental organizations could do even more to provide educational opportunities to the public and help them see the benefits of prioritizing greenspace and forested lands in particular.

There is a critical need for educating ourselves on why we need our forests and specific practical things we can do to protect them.

Education to our youth on the importance of forestry land and how to protect it.

Lack of knowledge and involvement by citizens.

People do not value forests and the conservation of them; there needs to be more environmental education in schools and for the general public.

Public misinformation about what are best forestry practices.

What are we teaching our kids in schools about biodiversity issues? This should be part of the curriculum in each grade so that children will be stewards of the Earth, not destroyers of the ecosystem.

Educating land trusts & local organizations to best forestry practices, how to maintain successional growth, and practical ways to deal with overwhelming invasives that now help support some species

I'm concerned that most Rhode Islanders are poorly informed about the value of forest ecosystems.

Invasive plant species. How to control and bring awareness to the public so good decisions are made when planting.

Kids (and adults) spend more and more time indoors or, if outdoors, in highly managed activities that take place in highly managed zones (playgrounds and athletic fields, campgrounds, or developed trails). Who will be the conservation advocates in the next generation if we don't think of ways to get people out into forests?

Lack of public knowledge of the benefits (including psychological) of green spaces.

###

Messaging gaps and opportunities: Some comments indicate messaging or educational opportunities.

Logging state forests and what I believe is a lack of minimal cleanup of forest floor after the logging contractor is finished harvesting the timber. This is a small state and the logger's activity is seen by many people trying to enjoy the local forests. More effort should be taken to be more thorough at the end of each logging contract. Also, it would be helpful to the lay person to post more information at each logging site i.e. typical logging practices, length of project, how long before the area affected will look more natural. Most forest users are not well informed on modern logging practices. Many people I know are upset with the appearance of a logged area (Carolina Mgmt. Area) after the contractor left.

Very concerned about the death of so many trees in the past two years. Can't the state do more to control Gypsy moths and the Two-lined Chestnut Borer? The state needs to be more proactive in getting information to property owners on how to protect their forest.

Is there a program to thin out thick forest growth? I see lots of old, sick and broken trees when I travel in western RI, which indicates that our forest resources are poorly managed.

Pressure to sell off state forest land to balance the budget.

We seem to very easily allow people to cut down our forests and ruin our wetlands that are supposed to be protected. Even if you try to call attention to it there is so much red tape that half a forest is destroyed before it gets stopped.

Where does the wood and funds go from management of Providence water supply lands as well as management areas?

People in Chepachet area seem to be allowed to clear cut many acres at a time without permits, repercussions

I am concerned that the results of this survey will be used to support a preservationist agenda (i.e. woodland protection bill). We need to promote a sustainable local forest product economy so that RI's privately owned forests can be economically viable enough so that they are not lost to residential development.

I think we should be sprayed when needed, caterpillars really do a # on trees of with a non-toxic spray.

I am concerned the Arcadia State Forest is not being maintained properly. In Exeter, RI, many trees were clear-cut on Summit Road and left on the ground.

Fires anywhere else in the country are legal outside fire bans when dry, even in the deserts. Why can you not have a fire? Do you truly understand how hard it is to start, never mind spread, a fire here in Rhode Island when compared to other parts of the country? I'm not ignorant or unknowing either. I'm an eagle scout and have traveled the country and some parts of the globe. I have back country camped in many places. I've made fire in a rain storm, as a test in scouts. Nowhere I have been is it as hard to make fire as it is here. Allow fire as back country sites. I'm not talking about a beach fire at beach pond. DEM just needs to be capable of making judgment calls. Educate them. found a fuel for wildfires.

I was concerned when the DEM didn't put up a bigger fight when the state tried to dump a power plant next to the George Washington management area.

I am quite concerned about the recent defoliation of the thousands of trees due to the recent caterpillars. How will DEM address the many blow downs to come?

I never heard publicly why Carolina Management Area South was deforested to the extent that it was. Hopefully there was solid husbandry practice behind the cutting.

The oaks are dying at an alarming rate. Sudden Oak Death is to blame, I am told. Is there a solution? Is anyone trying to find one?

Despite what URI says, old man's beard is also killing trees. They say it only attacks already sick trees. If you live in the woods, you'll note the exact opposite. Perfectly healthy trees get the beard and then they die. The so-called experts should get the heads out of the sand and find a solution instead of denying the truth.

Should dead trees be cut down and burnt to stop the spread of the Chestnut Borer, or other destructive organisms?

I am disturbed by the lack of nontoxic options for pest control. If invasions such as gypsy moths etc. represent an imbalance, fix the balance.

###

Other valid comments: Comments and observations for consideration.

Concerned that people see trees areas and think they are protected open space. They may not be. Someone owns the land we need to make sure we protect it from over development.

We own a forest and are happy to be good stewards. I'd like to see the state increase funding to buy properties as open space (some towns can't afford to do this, and land ends up as solar usage.) Forests need protection but we can't expect individual property owners to bear the burden for all.

Forests are an invaluable complex resource and asset essential as wildlife and human habitat, as watershed, global warming moderating variable, and repository for science and environmental health that is under threat from development.

Forests are a valuable asset to the state and the landowner. The landowner's rights over the agricultural silvicultural use of private property should take precedence over the communities wishes and desires.

Forests cannot be replaced once gone and I feel we need to preserve those we have for our recreational enjoyment, their benefit to the environment in releasing oxygen and absorbing CO₂, and also since they are home to so many wonderful wild species who share our state

Trading forest land for commercial-sized renewable energy facilities (e.g. solar arrays). We need BOTH to fight climate change so major green energy projects should instead be sited on old quarries, brownfields, etc.

Considering the air quality and water quality issues we're already experiencing in our state, we need to protect forest and native landscape from development. Forests help purify our air and water. Plants release oxygen, absorb carbon dioxide, absorb dust particles and reduce air pollution.

Deforestation and tree cutting for urban suburban development generally follows economic patterns and the building and housing markets. I want to know more about how we're dialing up conservation efforts in these key times.

I am concerned that forest land is significantly undervalued; it is not accorded sufficient value for its contribution to climate, to recreation, to tourist business, to wildlife, to habitat diversity, to quality of life.

Small parcels of forested land not qualified for funding for purchase, cumulative importance.

I have heard quite often lately that one of the best ways we can fight climate change is to plant and preserve trees. Existing forests should be treated as special to RI as Narragansett Bay.

Development pressure on forests has always made finding economic uses of standing forests a priority. For a while, development pressure was irresistible. Just as we were getting out the message that rural residential subdivisions are bad for towns and young people were choosing to live in urban communities and the pressure from large lot residential development was abating, along comes solar. Now with solar, there seems to be no way we can possibly come up with uses for standing forests that could possibly compete. What are we going to do to encourage people to save forests?

Farmers and other large land owners falling for the idea that using or clearing their land and placing solar panels on the property is good for the environment. People need to be aware of the great importance of trees to the environment (and their role in sequestering carbon!).

NON-FORESTED areas are creating water run-off problems, soil erosion, and loss of natural ground cover that wildlife welcomes. Need more conservation spaces around the state that are off limits to development.

Rural forest land quality is deteriorating as fragmentation, invasive, pests and the effects of warming climate go largely unchecked. As forest resources continue to decline it will have a domino effect on water, soil and wildlife resources.

Do good husbandry of existing conservation and open spaces to welcome the visitors to areas, perhaps promote features in schools. Start young, to promote wetlands, conservation lands, and forests free from developers.

Forest ecosystems should be given the same degree of priority and financial resources as that of commercial.

Forest carbon sequestration, oxygen generation and flood mitigation benefits need to be highlighted when considering forest loss.

Forests are a carbon sink, and RI will have trouble meeting air quality goals if forests are lost.

Our forested areas contribute to the appeal of our state adding to its desirability attracting visitors and contributing to our tourism industry.

The beauty of our state depends on the beautiful forests in our state. With tourism an important industry for the state, the depletion of forests will hurt this vital industry.

Intact and managed woodlands are good for tourism alongside multiple other uses.

With tick borne illness on the rise, people are afraid to go in the woods. We need to advance our public health system re: tick borne illness so that people have a positive relationship with the woods, and not a fear-based one. The more that people love the forest the more they will care about what happens to it. There is not a shared sense of stewardship among Rhode Islanders about the need to protect and preserve our forest land (public and private) and with a lack of care, developers are welcomed to do what they want.

Is there ANYWHERE we can go where we can get away from sound pollution light pollution? I don't believe there's anywhere left in RI or even on the east coast where you're not within the earshot of an airplane corridor or a train or a highway. In the same vein, the east coast is so light polluted, we can't see the Milky Way. Why isn't this of value?

We are losing all the ecosystem services that come from large tracks of preserved forest. Number 1 service is sufficient and clean water. No 2 loss of biodiversity that starts with native plants on forested land.

Without education and awareness, the public will not vote for measures where dollars are needed to provide effective planning, implementing policies and proper management of our forests as well as the wildlife, birds, bugs, plants that we are so quick to poison, kill, etc.

Forest health, primarily as a result of the loss of diversity and the imbalance caused by the introduction of numerous non-native plants and animals to the system and compounded by the stresses of a changing climate. Climate change is an enormous issue with few clear actions that managers can take, so reducing the compounding threats is paramount.

###

The seemingly high number of recreation-related comments were provided by fewer respondents than, for example, solar or fragmentation. The majority of comments are included here due to their variety and conflicting concerns, and the fact that multiple DEM divisions are responsible for various management areas, access and enforcement (making addressing issues in a comprehensive manner state-wide, with economic efficacy, significantly more problematic).

Recreation: Comments about recreation were the most varied of any theme, from increased access/management, signage/maps, off-road use, enforcement, dogs, and trash.

I'm concerned the DEM does not have the resources (read: money) to adequately manage the fine state-owned woodlands we are fortunate to have. Hunting-related funds help a lot but increasing recreational use will require increasing recreational funds.

The lack of DEM officers to respond to calls when something is going on.

The use of state forests being used as a dump site for garbage

Access to RI forests does not seem like a high priority. Arcadia and other areas are run down and seem neglected. We have some beautiful areas that need to be managed better so the public can enjoy them better. (Hiking Camping, Hunting)

Allow off-road vehicles to ride in Big River and other areas, not everywhere but motocross is a great sport for kids and needs to be made legal.

Biggest concern is the lack of resources going toward enforcement. People can, and do whatever they please in state management areas - including driving their motor vehicles, fires, littering etc.

Conservation by all user groups and have limited access for off-road motorcycles like most other states have. By acquiring funding that is available and currently being misused.

Control of anti-hunters during legal hunting season.

Goddard Park has massive erosion along the banks.

I don't like hunting and ATVs. They disturb me when hiking and they are detrimental to wildlife.

I am concerned that trail heads do not have trash barrels for hikers and hunters to use when finishing a day in the woods. Often, we find a lot of trash and debris and it could definitely be improved on.

Continue to promote use of natural areas by the public. If the public enjoys, uses and appreciates these areas they will want to protect them from development.

I am concerned about garbage left behind at recreation spots.

Continued access by the public. I'm concerned that specific groups frustrated by different types of recreation could cause trail closures. E.g. I lived in CA for years and much of the single track ridden by mountain bikers is now closed, much of which is due to some bikers taking advantage but mostly because very wealthy people with influence worked to get those trails closed.

Continued access for non-motorized use for recreational purposes of Rhode Islanders. It seems RI is far behind other states in managing its land to encourage recreational use while at the same time educating use in a sustainable manner. Many states have trail maps and trail names at the entrance of the trails to orient its new users.

Degraded parks.

DEM requests mostly deflected or, from my perspective, not much consideration given before the answer no to nearly every request for land access or use.

Easy access to forest areas.

I am concerned about the trash and dumping of waste that I see at trail heads and access points into RI forest lands.

Lack of awareness of general RI resident of nearby parks and forests. Snake Den in particular. There are no maps, scant signage.

I don't feel as if people who litter and are disrespectful to the environment or the creatures in it, are held accountable for their actions. Tough fines, community service restoring cleaning up our forest areas would be appropriate.

Access for motorsports.

I'm concerned the tourist or people not from here will ruin it via trash and misuse. Patrol is needed at heavy traffic locations.

I have seen some areas become dumping grounds for people which is really sad, especially in the Big River area. I am grateful to the organizations that try to clean it up.

Many recreational areas are full of illegal dumping grounds for trash and other items. These need to be cleaned up. Like the one about a quarter mile in the woods from Zeles bridge in Coventry and the Big River areas.

I am very much in favor of continued and potentially greater access for use by off-road motorcycles. Particularly by organized clubs like the Rhody Rovers MC and the RI Trials Club. I have been riding my motorcycles in RI forests since 1973 and would like to be able to continue doing so and for future generations to also have the opportunity to ride single track in the Rhode Island woods.

I enjoy mountain biking and do so mostly at Big River & Arcadia Management Areas. Many people enjoy the trails, whether it be biking, hiking or just walking the dog. Also, the many bodies of water provide enjoyment by canoe, kayaks & fishing. These areas need to be protected from commercial development.

Having actual, official marked trails would help draw more visitors and boost the economy in the surrounding area. Visitors spending money on supplies for their activity, places for multi-night day stays, dining out, etc. would all help build a recreational ecosystem.

I enjoy trail riding in Big River and Arcadia as well as kayaking the local rivers, ponds and lakes.

I regularly hike in the forest area surrounding Spring Lake in Burrillville. It is a beautiful area. However, there are several large discarded motor vehicle parts there: axles, body work, etc. of particular concern is a vehicle which appears to have been buried there quite some time ago. God only knows what the car is doing there or why it was buried. Only the roof hatchback area is slightly exposed. I think it would be work law enforcement investigating and having it removed for environmental reasons.

Loss of older forest tracts for game management like in the Great Swamp Management area. It seems there are plenty of fields and younger forest compared to older forest.

Poor marketing of available hiking trails. DEM trails and trail maps don't include many of the hiking trails in the forested areas we have available.

We need those parking spots for our personal safety, whether physical or item related.

Keeping trails open and access parking for horseback riders.

I would like to see guided tours of restricted areas; for example, the Scituate reservoir.

I think that we need to increase the visibility and number of the land managers rangers out on trails and in the most publicly used areas, in a year-round type role. Not enough positive presence means that users and user groups make their own rules and ruin the overall experience for everyone. A positive role model is the best fit, but some policing would also help.

I would like to see better communication between user groups and DEM, and between each other.

I would like to see them shared equitably for recreational use by a wide variety of groups including hikers, mountain bikers, equestrians etc. I would also like to see more of the trails blazed properly as other states do. I think this will bring more people comfortably into the woods.

I'm observing an increase in littering in forests on state parks and management areas (Lincoln Woods, Big River) both around parking areas, forest entrances, and on hiking trails.

It is important to maintain access for hunters and fishermen. Much of the land was acquired using Pitman Robinson Funding and the continued use will bring in additional dollars to maintain areas.

I've been taking the kids on nature walks lately. It's helping them get a sense for the importance and beauty of the natural world. I find the trails are pretty narrow in places and I spend way more time trying to keep the kids away from poison ivy than doing anything else.

Lack of parking at state locations. Lots of Big River parking spots have been blocked off to where you must park on the road risking your vehicle in an accident, risking yourself getting hit, exposing to non-hunters, anti-hunters, and other hunters your location which could get your vehicle damaged while in the woods, stands and/or cameras stolen. Those little parking spots I know attract mischief like illegal trash dumping.

Lack of access to state land for hunting and fishing.

I think recreational vehicles should be allowed on paths of different skill levels should be allowed. That is how some people enjoy the outdoors.

No place for off-road riding. I'd recommend an exterior trail around the boundary of a forest and reverse direction every year

Lack of facilities for trash disposal at recreation sites.

Preserving and maintaining current land for open using including hiking, fishing, hunting, and other activities.

Lack of trail maintenance.

Lack of usage allowed on state owned property,
Loss of hiking horse riding trails.

Not enough open area parks in the center of the state.

Main concern right now are all of the dead trees as a result of the gypsy moth caterpillars. I live around the corner from state owned Dawley Park in Richmond where close to 50% of the trees are now dead and losing their bark. I travel Dawley Park Rd twice daily, and many dead trees line the road. I contacted RI DEM state park division a few months ago regarding this matter, as I feel it is a public safety issue. I did not receive a response. I am terrified that someone is going to be killed by a falling tree or branch. A large branch broke off last week that certainly could have hurt someone badly if the timing had been so. I implore you to please have Dawley Park Road looked at. Once you get about a third down the road, there are more dead than live trees.

Maintaining shared of interest access for hiking and mountain biking along with other activities.
Working with hunting and equestrian to make trail systems accessible to all residents.

Motorized vehicles on hiking biking trails. They do incredible damage and are not conducive to the peaceful setting hikers, bikers, fishing, hunters are looking for. That being said, I hope you can find areas for them to enjoy, that they can claim as their own.

The limiting of access to certain user groups that do no harm and actually perform trails maintenance to help limit impact to the environment. Mountain biking.

My number one concern is the general impression that the state of RI, through its policies and implementation by the DEM have little interest in people using the forests for recreation outside of a few parks where activity is contained. In the larger, more remote areas activity policies discourage building or maintaining access. Why not allow signage on trails?

Hunters are easily frustrated with people who walk dogs and mountain bike during hunting seasons. They are very close to the main trails and often feel that making threatening comments are the answer.

RI really has a vibrant mountain biking community with some fantastic trail networks. It would be awesome to see RI exploit the bike tourism opportunity by creating maps, signage, and formalizing the trail centers. There are some great examples around the country (Marquette trails in MI, Sedona AZ, Burke VT, etc.

I frequently visit other states that have far more active programs to promote outdoor activity on forested lands. There are active partnerships between the state and various outdoor groups to build and maintain trails for hiking and biking and other uses. From what I have seen in RI this is virtually non-existent. The only cooperative relationship I have seen is between the AMC and some parks to the exclusion of other groups and activities. As AMC membership continues to decrease and the average age of their members continues to increase, the trails fall into greater and greater disrepair. Trails that were in decent shape five years ago are in poor shape now. Trails that were in poor shape five years ago barely exist today. Through its policies, the State of RI gives the appearance that they are happy with this situation.

Not enough access to public for recreational use.

Poor marketing of available hiking trails. DEM trails and trail maps don't include many of the hiking trails in the forested areas we have available.

Should be more flexible for ALL user groups to share the land.

That management is a regular occurrence to protect from invasive species, wildfires, litter, and trails mapped and maintained with signs.

That the Big River Area remain open and undeveloped.

That the roadways to and through the forests are not adequately maintained.

My biggest concern is access, I ride a mountain bike and want to know that I can use the existing trails that are in place.

I'm afraid that RI's corrupt government is going to take away great hiking fishing spots, and that my kid isn't going to be able to enjoy these activities like I was able to.

Would love to see RI embrace outdoor recreation in the State Forests robustly and in wooded State Parks as well (Lincoln Woods etc.).

A leave no trace policy. Heavy fines for dumping and polluting.

Bicycling is a healthier activity than horseback riding. Because horseback riding is a wealthier activity it is given preference over cycling. Cycling is an affordable use of public lands

Concerned overpromotion of forests will encourage more mass population to visit leading to damage to the forest and the experience it provides.

Why doesn't RI allow off-road vehicle use?

The mountain bikes are destroying the ground floor, causing washed out paths, killing native trout in streams that had them for many years, silt washing into our rivers and streams. They are cutting down small trees, illegally building new paths and pushing wildlife into roads and out of their habitat. Also bike paths are being built on and around our beautiful rocks and overlooks killing off the protected Lady Slippers. **THEY HAVE TO STOP ACTING LIKE ITS OK BECAUSE ITS HEALTHY TO RIDE BIKES IN OUR PARKS! ALSO STOP SELLING OUT OUR PARKS FOR NONPROFIT ORGANIZATIONS TO ALLOW IT TO HAPPEN!**

Trail maintenance for hiking and mountain biking (bridges over marsh areas, etc.).

Access to saltwater right of ways.

Acquire funding available to maintain and manage forestry for ALL user groups to share and enjoy, to include motorcycles.

Adequate space for all to enjoy.

All User groups should be held accountable for regular maintenance,

ATV damage and trespassing are damaging to open space.

ATVs and jeeps and trucks tearing up the forest, when hiking or mountain biking. I want to hear and see animals, not dirt bikes and people in jeeps partying.

I would like to see more woods open for outdoor activities like hiking and running.

Hunting, fishing access and education for the next generation.

I am concerned about the level of trash found along hiking trails and in public parklands.

Lack of hunting access – Organizations like the Aquidneck Land Trust do a great job protecting land but allow no access for hunting.

Our forests provide great recreational purposes that do not harm the environment with hiking and biking.

Create more backcountry camp sites in the state. There are some great public sites, but they are often overcrowded. I would love to see more remote, hike in, leave-no-trace sites in the area. Ideally even create a reservation system so I know my group can have privacy and enjoy the remote areas.

I'm concerned about access for mountain biking, hiking, and recreation.

Increasing amount of garbage left behind, especially broken bottles.

DEM recently allowed a motorcycle event in Carrs Pond Big River, on trails that mountain bikers and hikers maintain and care for. In one day, they did unfixable damage to those trails. Again, not against moto, just need to give them their own space and keep it limited to there.

Effects of overuse esp. off-road vehicles.

For the funding questions with the public. We need more hunters investing in licenses tags and stamps. If the general public gets involved, they create a non-hunting animal sanctuary for the mountain bikers and city hikers. We need less of that.

Forest bathing is a new form of outdoor recreation that should be promoted by DEM. You could set up stations in the woods with Adirondack chairs made from local lumber (you would probably have to bolt or chain them down). Forest bathing should be part of the great outdoor pursuit.

Forestry use is aimed towards hunters, not hikers. I have called the DEM to make sure I'm not taking my children hiking during hunting season. Very hard to read that guide document schedule for the negative hunt season. The guide is very pretty, though, now.

I am concerned about disputes over access. I believe that hikers, hunters, cyclists, etc. could all share the forests together and enjoy them.

Open the forests to 4x4 Overlanding groups. They are self-governed and take it upon themselves to organize clean-up runs and often maintain the trails for free. This is particularly good if DEM resources are low.

RI needs to follow the example of other states and develop a trail marking system to encourage use by the public and to aid emergency services in their search for persons in need of help.

Not enough recreation opportunities in existing forests. Would like to see recreation expanded to off-road vehicles.

Public access. We should have more access to state owned lands for hiking, canoeing, kayaking, and limited motorized vehicle use. Public access creates more interest.

I think some user groups activities are damaging to our forests and not properly monitored or controlled.

I'm not familiar with many forested recreational trails nearby to me. Maybe that's because not many exist, or because they are not well-advertised. Seems like the areas I know are quite small and fragmented.

It is quite unbelievable that RI has not allotted an area for recreational vehicles to be utilized. RI has thousands and thousands of acres of land that could be used, and it would take very little land and resources to make a place. They could post signs to alleviate liability and the public would be responsible for their access, self-enforcement and sanitation. We're going on 40 years of unnecessary and unfair restrictions.

Lack of access to areas for recreation.

Lack of maintenance and upkeep in general at recreation sites and on trails

Lack of publicly accessible land for ATV use

Making trails or areas that are available to hunters more clearly marked. We have been hiking and found hunters involved in a hunt and there was no clear sign stating they were actively hunting. I propose a sign that can be flipped or placed on the trail head sign to make other aware that the area is not only a hunting ground, but hunters are actively hunting at this time. It would have to be required that the hunters place sign up as part of their responsibility to safety.

Maintaining trails, but also making sure people are respecting spaces, especially public spaces. The amount of dog poop one can find along many trails is disheartening (and gross)

Motorcycle use creates significant damage to the trails in the woods for both hikers and mountain bikers. Motorcycles should have a dedicated area and should be kept out of the other areas.

Need to maintain forest for rural recreation such as hiking paths.

No RV trails for off road vehicles

That our management areas not be overrun by the myriad of activities allowed in them.

A complete listing of saltwater access points

Preserved for recreation, including motorized such off-road motorcycles.

Overly strict fur trapping regulations look to be based on mis-disinformation making it extremely difficult for recreational trappers to aid in wildlife conservation and management.

Pedal-assist ebikes should also be allowed in the areas. These types of ebikes do no more wear on trails than normal bikes and both are less than the equestrians. By allowing pedal-assist bikes, it opens up the opportunity for those which may otherwise not be able to ride (disabilities, older people, etc.) access to them.

People with dogs off their leash.

Trash. I believe in carry in, carryout. But most of the time it is teenagers (under aged drinking) leaving beer cans and trash in the woods. Hikers, campers, hunters, and fishers are responsible.

Pollution by humans that do not take out what they carry in. Many times, this summer I have found trash on the hiking trails. Lazy people that do not respect the forest. Charlestown has a large influx of non-residents during the summer and that is when this all happens.

Preserve the North South Trail at all costs. Maybe even expand upon it. More woods walking, less road walking.

Reduction of interest in hunting and fishing leading to one of the State's largest sources of income for wildlife and conservation to deplete rapidly.

We need more public open space such as wildlife management areas. Only 2% of all of RI is designated as such. Please use Robertson Pittman act funds to fund this.

Use in some by off-leash dogs, perhaps not a concern except in city forests.

Damage caused by recreational vehicles because of the absence of State maintained recreational vehicle trails.

Allowing all users to participate in activities and to have general meetings between recreational groups to decide what decision carries a mutual benefit for all parties.

Concerns and assistance by local groups like cyclist or hiking organizations seemingly are not taken seriously and allowed to help with issues the DEM might be able to take advantage, mitigating some of the workload.

The use of fireworks in heavily wooded forested areas.

I'm concerned that there is abuse to existing rules for bikers & hikers e.g. I bike ride and run in Ryan Park often and keep seeing motorcycle dirt bikes on the trail hauling ass and jumping hills. I respect the sport of dirt biking but there are designated trails for that, and I've never had an issue pulling my mountain bike over or allowing someone to pass. I've literally needed to jump in the woods to be avoided as they can't see or hear shit on dirt bikes.

Signage and trail mapping are needed in RI desperately, if for nothing else to expedite the extraction rescue of injured forest users. Trail maintenance is also crucial.

Trails meant for walking and hiking are being ruined by ATVs and motorized trail bikes.

The growth of some sports into new segments that include motorized use is concerning. The state has historically had the problem of motorcycles in some areas, but now there are user groups bringing in motorized bicycles, being called pedal assist, and the popularity of these could bring about new user conflicts and this needs some active management from the state (in the field) to properly address and correct where users are abusing their trail privileges.

Illegal dumping in our forests.

There is no enforcement of leash laws and curbing. More accessible parks have become overrun with dog feces and random dogs run over and jump on strangers. I love dogs but this is a dangerous situation that could get worse.

Trails not well kept.

It's less of a concern than preserving the ecological benefits of RI's forests, but I also believe that RI does not encourage recreational use of its forest lands as well as it could. The North-South Trail is underutilized, and the trails in Arcadia S.P. are not well signed, mapped or publicized.

Outdated or non-existent trail maps. Black hut management area is one I can think of. The area that runs the old herring pond drive and up through the quarries - the sign board is worn out. The part on black hut road, with the hunters parking area (near white rock). The old trails I grew up with are no longer there. The new trails aren't marked. No maps of the new trails.

Lack of access to public forests.

Hold ALL user groups accountable for helping to maintain the forests.

Trash. I have traveled By Car to EVERY STATE in the USA and spent at the least a day traveling around each state. From Boston to DC the country and roads are just filled with trash. Sticking with RI, where is the DEM? In other states you see them everywhere!?! In RI you only see them bothering some kid trail riding an ATV or sitting in a truck eating somewhere. What does this have to do with forests? The same goes for out (very few) trails and woodlands left. They are gross in many parts. I love those \$500-\$1000 fine signs. What a joke. I know of one in Greene, RI that has a pile of Dunkin Donuts coffee cups under it.

Why don't we plant and manage lands for hunting? Why don't we plant corn or clover in management areas for hunting?

Maintaining and improving recreation areas to help encourage people to enjoy and learn more about our forests and how to keep them healthy.

Between AMC, NEMBA, and the equestrian groups, the State should be leveraging our resources and manpower to assist in making our parks and forest recreation on par with our neighbors.

DEM moving their position of limiting off-road motorcycle events to certain trails and fire roads has been expanded to include trails that may be OK for a few dirt bikes to go through but not 50-100; should have stayed with the restrictions that were put in place.

Unlike states including Vermont and many out west we do not allow people to use the woodlands. We make so many rules and don't allow people to back country camp and bother people with so many permits and bullcrap that it turns people off but it also makes people more likely to sneak around and do it anyways, leaving their trash behind so they aren't caught carrying it out. Why are we so against education in our state? The Acadia area in Rhode Island is great with so much land, but who wants to hike so deep out and have to hike back because you can't camp 200' off a trail and leave no trace like you can in tons and tons of other places in the country.? If you educate and have actual rangers around, PEOPLE WHO LOVE TO USE SOMETHING WANT TO KEEP IT CLEAN! So maybe our forests would be better cared about and for if we allowed more people to feel a connection with the forests.

Four wheelers are a problem in many forests causing damage.

I'd love to see Dutch island open for exploration.

Illegal activity like drug dealing.

Lack of remote shelters for backpackers to enjoy.

Litter and trash in the forests.

Litter. Lack of knowledge of ordinary citizens of the access they have to many forests, trails, outdoor access. Living in RI everything is a drive away. We also need more awareness of positive impact forests, plants have in rural, suburban, and urban areas.

Misuse- dirt bikes, etc. that can damage wildlife.

More people picking up overflowing trash cans. I don't know exactly who's responsible for emptying trash cans. In other words.....reducing human footprint in the forest.

My husband & I go hiking around RI a lot & have been pleased to see how many cool parks of all sizes there are & how well maintained the trails often are. I hope the state continues to purchase properties to add to these forested lands, so that more wildlife has places to live & Rhode Islanders have more places to enjoy!

Noise and damage by snowmobiles.

Not enough state level integration and openly working with user groups that want to help with park upkeep, giving back etc.

Not enough trail systems

Off-roading destruction of forested areas. Damaged trails and forests aren't repaired.

Open access for all citizens to RI's forests

Pond at Arcadia needs to be reopened for swimmers.

Public access to state management areas. Take Big River for example. While public access is legal, it is not encouraged. Trails exist but there is no comprehensive trail system, trail markings, trail management.

Overuse of trail systems and degradation of the natural experience - too much emphasis on recreation and not enough on preservation, conservation and connection to nature.

User abuse like fires, trash, unauthorized use (ATVs).

Pollution (motorbikes, hiking)

Pollution. Would like more of an effort and campaign against littering, heavy fines, accountability.

Preserve unbroken forests for natural habitats and hiking.

Protection of existing conserved forest land from destruction and degradation due to: mountain bikes, horses, motorcycles dirt bikes, running events, military operations, off-road vehicles, and all other forms of non-passive recreation.

Putting forests in hands of special interest groups to manage forests for their own benefit, negating the interest of the rightful wildlife population.

Recreational use should be managed to keep forests pristine, including keeping cars and other motor vehicles including motorized boats out of public parks and waterways.

Restrictions enforced on vehicles both motorized and non-motorized that tear up the forest floor and or disturb the peace and tranquility of the area.

Safety. Trail sabotage is a real thing. On a positive note, I'm very thankful to live and work in a state that has so much land available to everyone. I fish, run, mountain bike and camp in this state and feel strongly that everyone needs to be respectful of all activities that are allowed in the state, including hunting.

Too many Massachusetts hunters particularly at Durfee hill. Frequently see Massachusetts hunting parties of 5+ doing deer drives

RI should have signs at trail heads explaining proper use of the trails. Like who can and can't, and general trail rules. I am an expert mountain biker who has ridden in our woods for 20+ years. As this sport is picking back up in popularity, and especially with the coming of e-mountain bikes, more people will be tempted to use trails inappropriately, like widening trails around rocks (known as dumbing down trails), or using trails after significant rainfall, etc...

Why is stealth camping illegal? Anywhere else in the country, for the most part, back country camping is legal as long as it is done responsibly. It's absurd a responsible adult cannot camp in the woods in Rhode Island.

APPENDIX F

Correlation to the DEM Strategic Plan 2019-22

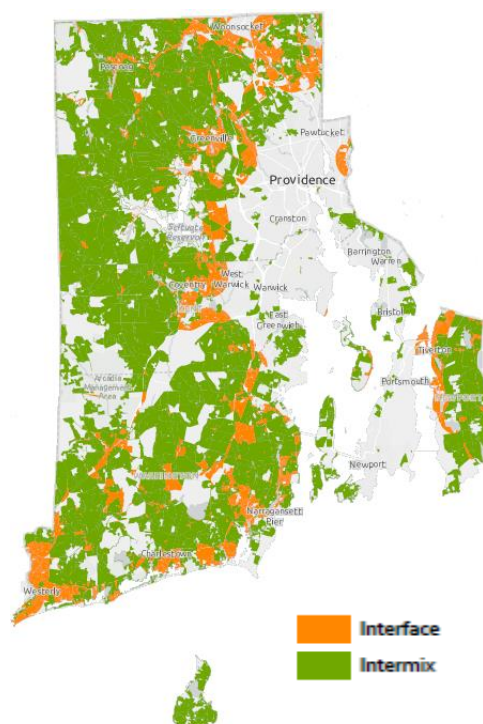
National Priority Issues

7. **Conserve** and Manage Working Forest Landscapes for Multiple Values and Uses
 - 1.1 Identify and conserve high priority forest ecosystems and landscapes
 - 1.2 Actively and sustainably manage forests
8. **Protect** Forests from Threats
 - 2.1 Restore fire-adapted lands and/or reduce risk of wildfire impacts
 - 2.2 Identify, manage, and reduce threats to forest and ecosystem health
9. **Enhance** Public Benefits from Trees and Forests
 - 3.1 Protect and enhance water quality and quantity
 - 3.2 Improve air quality and conserve energy
 - 3.3 Assist communities in planning for and reducing forest health risks
 - 3.4 Maintain and enhance the economic benefits and values of trees and forests
 - 3.5 Protect, conserve, and enhance wildlife and fish habitat
 - 3.6 Connect people to trees and forests, and engage them in environmental stewardship activities
 - 3.7 Manage trees and forests to mitigate and adapt to global climate change

DEM Priority Issues 2019-2022

DEM Strategic Plan 2019-2022

1. Take action to counter climate change and its effects, both locally and regionally.
2. Protect and restore our environment to create greener, healthier communities.
3. Protect and improve water quality.
4. Conserve, promote, and steward our natural resources.
5. Promote and increase outdoor recreation in Rhode Island.
6. Promote and expand local food and agricultural industries.
7. Demonstrate statewide leadership in customer service and continuous improvement.



DFE Priority Issues 2020-2030

- Fragmentation
- Water quality
- Forest health
- Fire
- Climate change

DFE Priority landscapes: Wildland-Urban interface/intermix

DFE contributes to multiple DEM goals, although its impact is limited due to lack of inclusion in both the planning and delivery process, under-staffing, and no state funding for planning or delivery.

1. Take action to counter climate change and its effects, both locally and regionally.

The existence and function of DFE contributes to **DEM Goal 1**:

- Promotion and education on the value and contributions of trees and forests in urban and rural areas
- Promoting good management practices in rural and urban forests

2. Protect and restore our environment to create greener, healthier communities.

While the examples for **DEM Goal 2** refer to policies and compliance, the existence of a robust DFE, appropriately funded and staffed, would actively help deliver this goal as all cooperative program outcomes focus on greener, healthier communities.

- The crux of most DFE messaging is the promotion of rural and urban forests for their contributions to green, healthier communities.
- The American Forests Tree Equity project is engaged in developing partnerships in public health.
- Strong policy efforts should support the retention of forest lands for clean air, water, stormwater management, wildlife and pollinators, climate change mitigation, etc. DFE should be at the table for these discussions.

3. Protect and improve water quality.

Healthy forests are a prime contributor to **DEM Goal 3**. Stormwater management is increasingly tied to the mitigating effects of rural and urban forests. Compliance and legislation are only one leg of a stool for addressing water quality which should include funding the management of state forests and supporting the retention of private forests, as working lands protect the source and quality of water. The mere existence of forests helps with water quality, the presence and health of fish, invertebrates, and benthics. Healthy and well-planned management of forests, contiguous forestlands, and upstream prioritization for forestland retention would directly benefit coastal and inland water management and restoration efforts.

4. Conserve, promote, and steward our natural resources.

DFE efforts are recognized specifically under **DEM Goal 4**, however, state funding to allow DFE help protect forests is not available. Supporting “terrestrial landscapes” requires staffing and financial commitments for necessary data and planning in order to identify, support and deliver meaningful programs and engagement. In addition, state agencies tend to develop and deliver their messaging in a virtual programmatic silo. Increased interaction between DEM divisions and state agencies would benefit all partners through shared external messaging and internal engagement.

5. Promote and increase outdoor recreation in Rhode Island.

Given the 40,000 acres of land under shared management with DFW, access and recreation are an important but under-funded element for passive and active recreation, resulting in under-managed and under-maintained management areas. DFE is an active partner in addressing **DEM Goal 5**, but lack of funding and staffing has a detrimental effect on a resource that is an important part of the recreational experience in RI.

6. Promote and expand local food and agricultural industries.

Contribution to **DEM Goal 6** is less apparent, but healthy forests are part of the working landscape. Forests also protect farmland by slowing or limiting the spread of pests or disease as a physical barrier, hosting weed seed and insect-eating birds, providing habitat for pollinators, and providing a secondary source of income from forest products. Retention of forests as working lands benefits agriculture.

7. Demonstrate statewide leadership in customer service and continuous improvement.

With respect to **DEM Goal 7**, DFE communicates messaging on multiple aspects of its program delivery,

through the commitment of staff to deliver education and customer service to the landowners, recreational users, foresters and loggers, residents and municipalities, news and professional organizations. However, present staffing and funding levels limit improvement to responsiveness and increased program delivery, even with the committed and professional staff.

Strategies Matrix

Conserve and manage working forest landscapes for multiple values and uses.			
Objectives	S&PF Program	Partners	DEM Strategic Plan Goals
Develop and expand existing planning and hazard monitoring capacity.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	2, 3, 4
Increase capacity for implementation of management recommendations to achieve resiliency goals.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	1, 2, 3, 4
Develop and deliver information on multiple platforms that addresses the identification and management of forest insect, disease, and non-native invasive threats.	FHM	URI RI Division of Agriculture	2, 4, 7
Increase collaboration with local partners' management efforts to address forest health.	FHM	URI RI Division of Agriculture	2, 4
Increase NIPF certified under the Forest Stewardship Program through targeted outreach to landowners in cooperation with partner groups.	FSP	NRCS RIFCO RIWP private	1, 3, 4
Promote forest management and conservation within spatial communities of small landowners using a landscape-scale approach.	FSP	NRCS RIFCO RIWP private	1, 3, 4
Maintain Rhode Island's active involvement in regional and national Cooperative Forest Management (CFM) committee.	FSP		4, 7
Increase the number of communities with active local urban and community forestry programs.	U&CF	RITC Local gov't	1, 2, 4
Improve technical and professional capacity of tree-care professionals and the green industry.	U&CF	RITC Local gov't	2, 4, 7
Advance community urban tree inventory and planning capabilities	U&CF	RITC Local gov't	2, 4, 7

Protect forests from threats.			
Objectives	S&PF Programs	Partners	DEM Strategic Plan Goals
Develop in-state wildfire response (surge) capacity and specialist skills.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	4, 7
Improve communication between in-state partners and responders.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	4, 7
Maintain fire response capacity.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	4, 7
Survey for native and non-native forest insect and disease threats and monitor for their outbreak and spread.	FHM	URI RI Division of Agriculture	2, 4
Work with regional and national partners to disseminate current information about the biotic and abiotic threats to RI's forests.	FHM	URI RI Division of Agriculture	2, 4
Maintain lines of contact and support structures for NIPF owners, via onsite visits, meetings, informational exchange, and site inspections.	FSP	NRCS RIFCO RIWP private	4, 6
Provide access to and information on relevant educational opportunities, current events, information, and funding opportunities.	FSP	NRCS RIFCO RIWP private	4, 6
Promote forestry BMPs, and expand messaging, especially in regard to harvesting operations, which should be inspected prior to harvest and during operations to prevent wetland violations.	FSP	NRCS RIFCO RIWP private	1, 3, 4, 6, 7
Develop disaster preparedness and rapid response capacity.	U&CF	RITC Local government	1, 2, 4
Promote trees and urban forests as an energy-saving practice.	U&CF	RITC Local government	1, 2, 4
Facilitate awareness and proactive response to invasive pests and diseases affecting trees in urban and rural forests.	U&CF	RITC Local government	1, 2, 4

Enhance public benefits from trees and forests.			
Objectives	S&PF Programs	Partners	DEM Strategic Plan Goals
Increase public awareness of wildfire and the need for preparedness.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	2, 4, 7
Incorporate a Firewise approach to wildland urban interface areas.	FIRE (SFA)	RIEMA DEM Fire Departments NFFPC members	2, 4, 7
Expand stakeholder engagement in collecting forest health information and disseminating forest health messaging.	FHM	URI RI Division of Agriculture	4, 7
Maximize messaging effectiveness by increased coordination with partners for responses regarding threats to RI's forests.	FHM	URI RI Division of Agriculture	4, 7
Promote active, sustainable forest management supporting wildlife habitat diversity, structural diversity, and understory health to landowners.	FSP	NRCS RIFCO RIWP private	2, 3, 4
Promote good silvicultural practices, to support forest health, ecosystem resiliency, wetland conservation, wildlife habitat, and carbon storage.	FSP	NRCS RIFCO RIWP private	2, 3, 4
Provide education and outreach on forest management for special areas, highlighting the relationships of private forestland to wetlands and water quality, air quality, climate protection, and urban-rural interface values.	FSP	NRCS RIFCO RIWP private	1, 2, 3, 4, 6, 7
Incorporate green infrastructure into municipal planning.	U&CF	RITC Local government	1, 2, 4
Assist communities with tree planting goals and plans.	U&CF	RITC Local government	1, 2, 4
Support statewide, regional and local tree advocacy groups.	U&CF	RITC Local government	1, 2, 4

APPENDIX G

Forest Legacy Program Assessment of Need

APPENDIX H

URLS for Referenced Links within the Forest Action Plan

URLs associated with graphs and other visuals are bolded; repeated links per page not included

Pages 1-62 ASSESSMENT

Page 1

- Cooperative Forestry Assistance Act <https://legcounsel.house.gov/Comps/Cooperative%20Forestry%20Assistance%20Act%20Of%201978.pdf>
- Food, Conservation, and Energy Act of 2008 www.agriculture.senate.gov/imo/media/doc/110-246%20-%20Food,%20Conservation,%20And%20Energy%20Act%20Of%202008.pdf
- State and Private Forestry www.fs.usda.gov/about-agency/state-private-forestry

Page 2

- **RI Wildlife Action Plan** www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- **Forests of Rhode Island, 2018** www.fs.fed.us/nrs/pubs/ru/ru_fs211.pdf
- 67% [Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995) Technical Paper 149] www.planning.ri.gov/documents/tp/TP%20149.PDF
- **New England Forest Cover and Human Population**
www.wildlandsandwoodlands.org/sites/default/files/Figure1_0.pdf
- **Wildlands and Woodlands, Farmlands and Communities: Broadening the Vision for New England**
www.wildlandsandwoodlands.org/sites/default/files/Wildlands%20and%20Woodlands%202017%20Report.pdf

Page 3

- RI Department of Administration Division of Statewide Planning
www.planning.ri.gov/publications/state-guide-plan.php
- increasing since the 1960s [Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995) Technical Paper 149] www.planning.ri.gov/documents/tp/TP%20149.PDF
- 9% yearly since 2011 [HUD PD&R Housing Market Profiles: RI]
www.huduser.gov/portal/periodicals/USHMC/reg/RhodeIsland-HMP-May18.pdf
- 6,027 miles of permanent roads www.fhwa.dot.gov/policyinformation/statistics/2017/hm10.cfm
- **HUD PD&R Housing Market Profiles: RI**
www.huduser.gov/portal/periodicals/USHMC/reg/RhodeIsland-HMP-May18.pdf

Page 4

- USDA Forest Service www.fs.usda.gov/
- Forest Inventory Analysis www.fia.fs.fed.us/
- Department of Environmental Management www.dem.ri.gov/
- Wildlife Action Plan www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- annualized forest census www.fia.fs.fed.us/
- Forests of Rhode Island, 2018 www.fs.fed.us/nrs/pubs/ru/ru_fs211.pdf
- 2010 State Forest Action Plan www.dem.ri.gov/programs/bnatres/forest/pdf/assestra.pdf

Page 5

- ~3/4s of Rhode Island's canopy
www.providencejournal.com/news/20170505/gypsy-moths-are-back-ready-to-devour-ri
- **Forests of Rhode Island, 2017** www.fs.fed.us/nrs/pubs/ru/ru_fs162.pdf

Page 6

- Forest type www.nrs.fs.fed.us/fia/data-tools/state-reports/glossary/

Page 7

- Forest Futures Dashboard www.nrs.fs.fed.us/futures/dashboard/current/?var=AGE_100&state=RI
- **Forests of Rhode Island, 2017** www.fs.fed.us/nrs/pubs/ru/ru_fs162.pdf

Page 8

- USDA Forest Service Report from 1957 [*The Timber Resources of Rhode Island* by Ferguson & McGuire] <https://books.google.com/books?id=pltOAAAAMAAJ&newbks=0&printsec=frontcover&hl=en#v=onepage&q&f=false>
- By the late 1980's [*Family Forest Owners of the United States*, 2006 by Butler] www.nrs.fs.fed.us/pubs/gtr/gtr_nrs27.pdf
- 2020 State and Private Forestry Fact Sheet https://apps.fs.usda.gov/nicportal/temppdf/sfs/naweb/ri_std.pdf
- **Forests of Rhode Island, 2017** www.fs.fed.us/nrs/pubs/ru/ru_fs162.pdf
- Forests of Southern New England www.fs.fed.us/nrs/pubs/rb/rb_nrs97.pdf
- survey of landowners www.dem.ri.gov/programs/bnatres/forest/pdf/assestra.pdf
- **Forests of Rhode Island, 2013** www.fs.fed.us/nrs/pubs/ru/ru_fs18r.pdf
- 2013 National Woodland Owner Survey [*Family Forest Ownerships of the United States*, 2013] www.fs.fed.us/nrs/pubs/jrnl/2016/nrs_2016_butler_001.pdf

Page 9

- Additional research [*Hidden in Plain Sight*] www.forestfoundation.org/woodland-owners-protecting-wildlife
- USDA Forest Service www.fs.usda.gov/
- USDA Natural Resources Conservation Service www.nrcs.usda.gov/wps/portal/nrcs/site/ri/home/
- Agricultural Act of 2014 (P.L. 113-79) www.agriculture.senate.gov/imo/media/doc/Agricultural%20Act%20of%202014.pdf
- Department of Environmental Management www.dem.ri.gov/
- Farm, Forest and Open Space www.dem.ri.gov/programs/agriculture/documents/ffosa_citizens_guide.pdf

Page 10

- 2010 census www.census.gov/data/tables/2010/dec/density-data-text.html
- Urban forests www.fs.usda.gov/managing-land/urban-forests
- Urban Services Boundary www.rigis.org/datasets/urban-services-boundary The Nature Conservancy www.nature.org/en-us/about-us/where-we-work/united-states/rhode-island/
- Audubon Society of RI <https://asri.org/>
- Providence Water www.provwater.com/watershed
- University of Rhode Island W. Alton Jones Campus <https://web.uri.edu/wajc/>
- Rhode Island Forest Conservators Organization www.rifco.org/
- Rhode Island Association of Conservation Districts www.riacd.org/
- Northern www.nricd.org/
- Southern <https://sricd.org/>
- Eastern www.easternriconservation.org/

Page 11

- Rhode Island Tree Council www.ritree.org/
- Rhode Island Woodland Partnership <https://rhodeislandwoods.uri.edu/ri-woodland-partnership/>
- Forest Ecosystem Monitoring Cooperative www.uvm.edu/femc
- Regional Conservation Partnership <https://rcpnetwork.org/>
- American Tree Farm System www.treefarmssystem.org/
- RI Tree Farm Database www.treefarmssystem.org/rhode-island
- Sustainable Forestry Initiative www.sfiprogram.org/
- Forest Stewardship Council <https://us.fsc.org/en-us>

Page 12

- Forest Environment www.dem.ri.gov/programs/forestry/
- Fish and Wildlife www.dem.ri.gov/programs/fish-wildlife/

Page 13

- Forests of Rhode Island, 2017 www.fs.fed.us/nrs/pubs/ru/ru_fs162.pdf
- Local Agricultural Seafood Act www.dem.ri.gov/programs/agriculture/grants-lasa.php
- Farm, Forest, and Open Space www.dem.ri.gov/programs/agriculture/ffosa.php

Page 14

- Forestry Best Management Practices for Water Quality Protection www.rifco.org/publications.htm

- 33 sawmills <http://www.dem.ri.gov/programs/bnatres/forest/pdf/riforest.pdf>
- 16 local sawmills [*The Timber Industries of Southern New England* by Nevel & Wharton] www.fs.fed.us/ne/newtown_square/publications/resource_bulletins/pdfs/scanned/OCR/ne_rb101.pdf
- Economic Impact of Rhode Island's Forestry and Wood Products Sector <https://riepr.org/pdf/ri-forestry-and-wood-products-2019.pdf>
- Rhode Island Forest Based Economy [*The Economic Importance of Rhode Island's Forest Based Economy*] www.dem.ri.gov/programs/forestry/documents/econimp15.pdf
- 2014 report www.eia.gov/todayinenergy/detail.php?id=15431
- 2003 landowner survey www.dem.ri.gov/programs/forestry/documents/assestra.pdf

Page 15

- **2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation** www2.census.gov/programs-surveys/fhwar/publications/2011/fhw11-ri.pdf
- 2018 Parks Study [*Rhode Island State Parks Organizational Management and Operations Study*] www.dem.ri.gov/riparks/documents/RIDEM%20Parks%20Study-Full%20Report%20-%20web%202019-1-16.pdf
- 2019 Ocean State Outdoors State Guide Plan www.planning.ri.gov/documents/LU/2019/SGP-152-SCORP-2019.pdf
- assessing the economic importance Rhode Island's forests www.dem.ri.gov/programs/forestry/documents/econimp15.pdf

Page 16

- 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation www2.census.gov/programs-surveys/fhwar/publications/2011/fhw11-ri.pdf
- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- DEM Fish & Wildlife www.dem.ri.gov/programs/fish-wildlife/
- American Farmland Trust [*Cost of Community Services Studies by Freedgood*] https://s30428.pcdn.co/wp-content/uploads/sites/2/2019/09/AFT_COCS_Making_the_Case_Final.pdf
- compilation of data from across the US https://s30428.pcdn.co/wp-content/uploads/sites/2/2019/09/Cost_of_Community_Services_Studies_AFT_FIC_201609.pdf

Page 17

- local communities [*Community Conservation Fact Sheet #1*] www.scituateriltcc.org/uploads/1/3/6/0/13607660/fact_sheet_-_saving_land.pdf
- open spaces enhance community property values [*The impact of parks on property values by Crompton*] www.tandfonline.com/doi/abs/10.1080/13606710500348060?src=recsys&journalCode=rmle20
- employment rates tend to increase [*Assessing the local economic impacts of land protection*] <https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/cobi.13318>

Page 18

- BANKING ON GREEN: How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits www.asla.org/uploadedFiles/CMS/Government_Affairs/Federal_Government_Affairs/Banking%20on%20Green%20HighRes.pdf
- green infrastructure [*A Short History of the Term Green Infrastructure* by Firehock] www.gicinc.org/PDFs/GI%20History.pdf
- Resilient Rhody <http://climatechange.ri.gov/documents/resilientrhody18.pdf>
- Overview of a Changing Climate in Rhode Island <https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/united-states/east-coast/new-england/Valee--Giuliano.-2014.-CC-in-Rhode-Island-Overview.pdf>
- research [*Leaf-out Dates Highlight a Changing Climate*] www.usanpn.org/files/LeafOutHighlightChange_Arnoldia_.pdf
- Natural Climate Solutions www.pnas.org/content/pnas/114/44/11645.full.pdf

Page 19

- Rhode Island Greenhouse Gas Emissions Reduction Plan <http://climatechange.ri.gov/documents/ec4-ghg-emissions-reduction-plan-final-draft-2016-12-29-clean.pdf>
- Resilient Rhody <http://climatechange.ri.gov/resiliency/>

- 2007 literature review and public data analysis [*Climate Change, Carbon and the Forests of the Northeast*] https://foreststewardsguild.org/wp-content/uploads/2019/06/ForestGuild_climate_carbon_forests.pdf
- **Climate Change, Carbon and the Forests of the Northeast** https://foreststewardsguild.org/wp-content/uploads/2019/06/ForestGuild_climate_carbon_forests.pdf
- Forests of Rhode Island, 2017 www.fs.fed.us/nrs/pubs/ru/ru_fs162.pdf
- Forest Inventory and Analysis Program www.fia.fs.fed.us/forestcarbon/index.php
- Forest Inventory EVALIDator <https://apps.fs.usda.gov/Evalidator/evalidator.jsp>

Page 20

- **The Value of Rhode Island Forests** <http://dem.ri.gov/programs/forestry/forest-value.php>
- Greenhouse Gas Emissions from a Typical Passenger Vehicle www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle
- registered in Rhode Island in 2016 www.statista.com/statistics/196068/number-of-registered-automobiles-in-rhode-island/
- Forest Inventory EVALIDator <https://apps.fs.usda.gov/Evalidator/evalidator.jsp>

Page 21

- green infrastructure [*A Short History of the Term Green Infrastructure by Firehock*] www.gicinc.org/PDFs/GI%20History.pdf
- **How Trees & Forests Really Affect Stormwater** <https://urbanforestrysouth.org/resources/library/ttresources/give-me-the-numbers-how-trees-and-urban-forest-systems-really-affect-stormwater-runoff>
- Woonasquatucket Vision Plan www.providenceri.gov/wp-content/uploads/2017/08/Woony_IntroChapter1-20180706-Reduced.pdf
- restore <https://wrwc.org/what-we-do/restoration/>

Page 22

- Urban Nature for Human Health and Well-Being www.fs.usda.gov/sites/default/files/fs_media/fs_document/urbannatureforhumanhealthandwellbeing_508_01_30_18.pdf
- The Human Health and Social Benefits of Urban Forests www.dovetailinc.org/upload/tmp/1579728766.pdf
- Human Dimensions of Urban Forestry and Urban Greening www.naturewithin.info/
- RI Behavioral Health Project: Final Report <https://bhddh.ri.gov/mh/pdf/Truven%20Rhode%20Island%20Behavioral%20Health%20Final%20Report%209%2015%202015.pdf>
- High School Youth Risk Behavior Surveillance <https://nccd.cdc.gov/Youthonline/App/Default.aspx>
- ADHD Prevalence www.cdc.gov/ncbddd/adhd/prevalence.html
- program www.parkrx.org/
- Park Rx <https://bodiesminds.org/programs/park-rx/>
- Urban Forests for Climate and Health Initiative www.americanforests.org/wp-content/uploads/2019/09/Rhode-Island-Urban-Forests-for-Climate-and-Health-Initiative.pdf
- Health Equity Zones https://health.ri.gov/programs/detail.php?pgm_id=1108
- Northern Institute of Applied Climate Science www.nrs.fs.fed.us/niacs/
- Clean Air Act www.epa.gov/clean-air-act-overview

Page 23

- Division of Air Resources www.dem.ri.gov/programs/air/
- 2018 RI Annual Monitoring Network Plan <http://dem.ri.gov/programs/air/documents/airnet18.pdf>
- State of the Air www.stateoftheair.org/city-rankings/states/rhode-island/
- A Framework for Examining Social Stress and Susceptibility to Air Pollution in Respiratory Health www.ncbi.nlm.nih.gov/pmc/articles/PMC2737009/
- Outdoor Air Pollution and Asthma [www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(14\)60617-6.pdf](http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(14)60617-6.pdf)
- The medications that change who we are www.bbc.com/future/article/20200108-the-medications-that-change-who-we-are
- RIDOH data <https://static1.squarespace.com/static/546d61b5e4b049f0b10b95c5/t/5c65f25353450a82b2e0a4e9/1550185066098/Community+%20asthma+presentation+-+Greater+Providence+Area.pdf>

- Henry J Kaiser Family Foundation www.kff.org/other/state-indicator/asthma-prevalence-by-gender/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D
- Annals of the American Thoracic Society [*Economic Burden of Asthma in the United States, 2008-2013*] www.atsjournals.org/doi/full/10.1513/AnnalsATS.201703-259OC
- Recent research www.the-scientist.com/news-opinion/trees-tested-as-pollutant-traps-65940
- i-Tree Canopy <https://canopy.itreetools.org/>
- rural www.ers.usda.gov/webdocs/DataFiles/53180/25594_RI.pdf?v=0
- Tree and forest effects on air quality and human health in the United States www.fs.fed.us/nrs/pubs/jrnl/2014/nrs_2014_nowak_001.pdf

Page 24

- Development and refinement of modeling tools www.researchgate.net/publication/316054732_A_Methodology_for_Calculating_Cooling_from_Vegetation_Evapotranspiration_for_Use_in_Urban_Space_Microclimate_Simulations
- urban heat island effect www.gardinergreenribbon.com/heat-island-effect/
- Research [*Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation*] www.coolrooftoolkit.org/wp-content/uploads/2012/04/Akbari-Health-Benefits-LA.pdf
- urban greening to cool towns and cities www.sciencedirect.com/science/article/pii/S0169204610001234
- **Heat Island Impacts** www.usgs.gov/media/images/urban-heat-islands
- Department of Health <https://health.ri.gov/>
- extreme heat and negative health outcomes <https://health.ri.gov/data/heatstress/index.php>

Page 25

- Drivers of Urban Heat Islands www.nasa.gov/topics/earth/features/heat-island-sprawl.html
- Climate Change Program https://health.ri.gov/programs/detail.php?pgm_id=174
- Health Equity Zones https://health.ri.gov/programs/detail.php?pgm_id=1108
- Energy-Saving Trees <https://energysavingtrees.arboday.org/?partnerCode=07424#ContactUtility>
- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- Species of Greatest Conservation Need www.dem.ri.gov/programs/bnatres/fishwild/swap/sgcncomm.pdf
- 84 key habitat profiles www.dem.ri.gov/programs/bnatres/fishwild/swap/RIWAP-Appendix2a-b.pdf

Page 26

- silvicultural recommendations for supporting bird habitat <https://rhodeislandwoods.uri.edu/wildlife/forestry-for-ri-birds/>
- Food and Agriculture Organization of the United Nations www.fao.org/3/I9527EN/i9527en.PDF
- The Value of Rhode Island Forests <http://dem.ri.gov/programs/forestry/forest-value.php>

Page 27 – 0

Page 28

- study [*Habitat fragmentation and its lasting impact on Earth's ecosystems*] www.ncbi.nlm.nih.gov/pubmed/26601154
- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- **The Forests of Southern New England, 2012** www.fs.fed.us/nrs/pubs/rb/rb_nrs97.pdf
- **ESRI Green Infrastructure Strategy** www.esri.com/en-us/industries/green-infrastructure/overview?utm_source=PR&utm_medium=sm&utm_term=June&utm_content=green+infrastructure&utm_campaign=green_infrastructure

Page 29

- Loss of forest in large unfragmented blocks of forest in Rhode Island https://web.uri.edu/forestry/files/2019/02/Bufum-2019-Loss-of-forest-in-large-unfragmented-blocks-of-forest-in-Rhode-Island_May2019.pdf
- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- RI Statewide Planning [*Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995) Technical Paper 149*] www.planning.ri.gov/documents/tp/TP%20149.PDF

Page 30

- 1985 and 1998 [*Forest statistics for Rhode Island: 1985 and 1998*] www.fs.usda.gov/treesearch/pubs/20934

- greatest forest loss in southern New England www.fs.fed.us/nrs/pubs/rb/rb_nrs97.pdf
- Clean Energy Goal www.energy.ri.gov/renewable-energy/governor-clean-energy-goal.php
- America 2050 www.america2050.org/megaregions.html

Page 31

- **America 2050** www.america2050.org/megaregions.html
- i-Tree Landscape Tool <https://landscape.itreetools.org/>
- Wildland-Urban Interface www.firewords.net/definitions/next_round/wildland_urban_interface.htm
- Wildland-Urban Intermix www.firewords.net/definitions/next_round/wildland-urban_intermix.htm
- Silvis Lab <http://silvis.forest.wisc.edu/data/wui-change/>

Page 32

- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- ESRI Green Infrastructure Strategy www.esri.com/en-us/industries/green-infrastructure/overview?utm_source=PR&utm_medium=sm&utm_term=June&utm_content=green+infrastructure&utm_campaign=green_infrastructure
- The Clark Labs 2050 Conterminous US Land Cover Prediction <https://clarklabs.org/terrset/land-change-modeler/>

Page 33-34 – 0

Page 35

- Forest Health webpage www.dem.ri.gov/programs/forestry/forest-health/emerald-ash-borer/

Page 36

- **Status of Asian Longhorn Beetle Spread and Control**
www.aphis.usda.gov/plant_health/plant_pest_info/asian_lhb/downloads/albmaps/alb-program-progress-map.pdf

Page 37

- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php
- Identifying relationships between invasive species and species of greatest conservation need
https://rcngrants.org/sites/default/files/final_reports/Final%20Report.pdf

Page 38

- Forests of Southern New England, 2012 www.fs.fed.us/nrs/pubs/rb/rb_nrs97.pdf
- **Rhode Island's Forest Resources, 2010** www.nrs.fs.fed.us/pubs/rn/rn_nrs113.pdf
- Partners in Flight <http://pif.birdconservancy.org/>
- Guidelines for Managing Wood Thrush and Scarlet Tanager Habitat in the Northeast and Mid-Atlantic Regions
<http://highbranchconservation.com/wp-content/uploads/2017/02/Guidelines-for-Managing-Wood-Thrush-and-Scarlet-Tanager-Habitat-in-the-Northeast-and-Mid-Atlantic-Regions-2017.pdf>

Page 39

- deer densities www.dem.ri.gov/programs/bnatres/fishwild/pdf/deer.pdf
- ungulates and forest management implications [*Subcontinental-scale patterns of large-ungulate herbivory and synoptic review of restoration management implications for midwestern and northeastern forests*]
www.nrs.fs.fed.us/pubs/57317
- well-documented [*White-tailed Deer in Northeastern Forests* by Rawinski]
www.fs.usda.gov/naspf/sites/default/files/NA-IN-02-14_WhitetailedDeerNEForestsWEB.pdf
- Does white-tailed deer density affect tree stocking in forests of the Eastern United States?
<https://ecologicalprocesses.springeropen.com/articles/10.1186/s13717-019-0185-5>

Page 40

- USFS 2009 analysis [Forests, Water and People]
www.fs.usda.gov/naspf/sites/default/files/forests_water_people_watersupply.pdf
- Clean Water Act www.epa.gov/laws-regulations/summary-clean-water-act
- Office of Water Resources www.dem.ri.gov/programs/water/quality/
- Scituate Reservoir of the Providence Water Supply Board www.provwater.com/watershed

Page 41

- Safe Drinking Water Information System www.epa.gov/enviro/sdwis-overview
- Sole Source Aquifers https://www3.epa.gov/region1/eco/drinkwater/pc_solesource_aquifer.html
- 490 public water supply systems
www.planning.ri.gov/documents/guide_plan/RI%20Water%202030_06.14.12_Final.pdf
- American Water Works Association www.awwa.org/Resources-Tools/water-knowledge/source-water-protection
- High Rock Lake watershed
www.ncforestservice.gov/water_quality/pdf/ForestsWaterQualityHighRockLakeWatershed.pdf
- Journal of the American Water Works Association [*Protecting forested watersheds is smart economics for water utilities*] www.nation.on.ca/sites/default/files/AWWA%20Watershed%20Paper_0.pdf
- Impaired Waters Report www.epa.gov/sites/production/files/2018-04/documents/2016-ri-303d-list-report.pdf
- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php

Page 42

- Changing Landscapes, USDA NA–TP–01–14 A3 www.fs.usda.gov/naspf/sites/default/files/publications/na-tp-01-14_changing_landscapes_combined_file_20180906.pdf
- USFS www.fs.usda.gov/learn/trees
- **Precipitation Movement in the Landscape**
<https://urbanforestrysouth.org/resources/library/ttresources/give-me-the-numbers-how-trees-and-urban-forest-systems-really-affect-stormwater-runoff>
- Lehman College <https://courses.lumenlearning.com/cuny-lehman-geo/chapter/human-impact-floods/>
- Oct 2016 in Stormwater www.stormh2o.com/home/article/13026514/give-me-the-numbers

Page 43

- RI WAP www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php

Page 44– 0

Page 45

- **ESRI Green Infrastructure Strategy** www.esri.com/en-us/industries/green-infrastructure/overview?utm_source=PR&utm_medium=sm&utm_term=June&utm_content=green+infrastructure&utm_campaign=green_infrastructure

Page 46 – 0

Page 47

- Stafford Act www.fs.usda.gov/managing-land/fire/master-agreement-template
- National Fire Danger Rating System
www.fs.usda.gov/detail/cibola/landmanagement/resourcemanagement/?cid=stelprdb5368839
- GOES16 satellite system www.goes-r.gov/
- RIEMA www.riema.ri.gov/
- Firewise® www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA

Page 48

- Incident Team Management www.usfa.fema.gov/training/imt/imt_overview.html
- Community Wildfire Protection Plan www.forestsandrangelands.gov/resources/communities/index.shtml
- Prudence Island http://nbnerr.org/wp-content/uploads/2018/08/Prudence-Island-CWPP_FINAL.pdf

Page 49

- Climate Change and Adaptation: New England and Northern New York Forests
<https://usfs.maps.arcgis.com/apps/MapSeries/index.html?appid=a4babe8e2fe849739171e6824930459e>

Page 50

- 2006 Northeast Climate Impacts Assessment
https://climateshift.com/downloads/northeast/rhode-island_necia.pdf
- Climate Change and Adaptation
<https://usfs.maps.arcgis.com/apps/MapSeries/index.html?appid=a4babe8e2fe849739171e6824930459e>

Page 51

- Climate Change and Adaptation <https://usfs.maps.arcgis.com/apps/MapSeries/index.html?appid=a4babe8e2fe849739171e6824930459e>
- New England and Northern New York Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the New England Climate Change Response Framework Project www.fs.fed.us/nrs/pubs/gtr/gtr_nrs173.pdf
- modelling predictions <https://usfs.maps.arcgis.com/apps/MapSeries/index.html?appid=a4babe8e2fe849739171e6824930459e>
- 2006 Northeast Climate Impacts Assessment https://climateshift.com/downloads/northeast/rhode-island_necia.pdf

Page 52

- detrimental effect on northern forest growth [*Declines in northern forest tree growth following snowpack decline and soil freezing*] <https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14420>
- *Climate Change is Shrinking Winter Snowpack* <https://theconversation.com/climate-change-is-shrinking-winter-snowpack-which-harms-northeast-forests-year-round-103410>

Page 53

- Stewardship www.dem.ri.gov/programs/forestry/stewardship/index.php
- Forest Health www.dem.ri.gov/programs/forestry/forest-health/index.php
- Fire www.dem.ri.gov/programs/forestry/fire-program/index.php
- Urban & Community Forestry www.dem.ri.gov/programs/forestry/urban-forestry/
- i-Tree Landscape Tool <https://landscape.itreetools.org/>
- Wildland-Urban Interface www.firewords.net/definitions/next_round/wildland_urban_interface.htm
- Wildland-Urban Intermix www.firewords.net/definitions/next_round/wildland-urban_intermix.htm
- **Researchgate.net** www.researchgate.net/publication/324174291_Long-Term_Changes_of_the_Wildland-Urban_Interface_in_the_Polish_Carpathians

Page 54

- Forest Legacy Program www.dem.ri.gov/programs/forestry/forestlegacy/
- Silvics Labs, University of Wisconsin-Madison <http://silvis.forest.wisc.edu/data/wui-change/>

Page 55

- Silvics Labs, University of Wisconsin-Madison <http://silvis.forest.wisc.edu/data/wui-change/>

Page 56

- Northeastern Forest Fire Protection Compact www.nffpc.org/en/
- Urban Forest Inventory Analysis www.fia.fs.fed.us/program-features/urban/
- Natural Resources Conservation Service www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/home/?cid=stelprdb1047780
- The Last Green Valley <https://thelastgreenvalley.org/learn-protect/agriculture-forestry/southern-new-england-heritage-forest/>
- MassConn Sustainable Forest Partnership <https://grassrootsfund.org/groups/massconn-sustainable-forest-partnership>
- Northern Rhode Island Conservation District www.nricd.org/
- The Southern New England Heritage Forest <https://thelastgreenvalley.org/learn-protect/agriculture-forestry/southern-new-england-heritage-forest/>
- Regional Conservation Partnership Program www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/
- Landscape Scale Restoration www.fs.usda.gov/managing-land/private-land/landscape-scale-restoration
- Forest Stewards Guild <https://foreststewardsguild.org/>
- RI Woodland Partnership <https://rhodeislandwoods.uri.edu/ri-woodland-partnership/>

Page 57

- FEMC www.uvm.edu/femc
- RIWP <https://rhodeislandwoods.uri.edu/ri-woodland-partnership/>

Page 58

- DEM Facebook www.facebook.com/RhodeIslandDEM
- www.wufoo.com www.wufoo.com/

Page 59-61 – 0

Page 62

- The Value of RI Forests <http://dem.ri.gov/programs/forestry/forest-value.php>
- RITC www.ritree.org/
- RIWP <https://rhodeislandwoods.uri.edu/ri-woodland-partnership/>

Pages 62 – 92 STRATEGIES

Page 60

- Agricultural Act of 2014 (P.L. 113-79)
www.agriculture.senate.gov/imo/media/doc/Agricultural%20Act%20of%202014.pdf

Page 61

- DEM Strategic Plan 2019-22 www.dem.ri.gov/director/documents/plan2018-22.pdf

Page 62-66 – 0

Page 67

- Forest Fire Program www.dem.ri.gov/programs/forestry/fire-program/index.php
- National Cohesive Wildland Fire Management Strategy
www.forestsandrangelands.gov/strategy/thestrategy.shtml
- Northeastern Forest Fire Protection Compact www.nffpc.org/en/
- Rhode Island Fire Chiefs Association <https://rifirechiefs.com/>
- Rhode Island State Firemen's League www.risfl.com/

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- State Hazard Mitigation Plan www.riema.ri.gov/resources/citizens/mitigation/mitigationplanning.php
- Comprehensive Emergency Management Plan
www.riema.ri.gov/resources/emergencymanager/prepare/state-plan/index.php

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- Wildfire Risk Reduction www.fs.usda.gov/naspf/working-with-us/grants/cohesive-fire-strategy-request-proposals
- Community Wildfire Protection Plan www.nwcg.gov/term/glossary/community-wildfire-protection-plan-cwpp
- Prudence Island http://nbnerr.org/wp-content/uploads/2018/08/Prudence-Island-CWPP_FINAL.pdf

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- Values at Risk www.nwcg.gov/term/glossary/values-at-risk

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- National Cohesive Wildland Fire Management Strategy www.fs.fed.us/restoration/cohesivestrategy.shtml

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- Fire Adapted Communities <https://fireadapted.org/>
- Firewise www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA
- Ready- Set-Go www.readyforwildfire.org/prepare-for-wildfire/ready-set-go-campaign/

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- Cooperative Forest Health Protection www.fs.usda.gov/naspf/programs/forest-health-protection
- FSM 3400 www.fs.fed.us/cgi-bin/Directives/get_dirs/fsm?3400
- National Forest Health Monitoring www.fs.fed.us/foresthealth/protecting-forest/forest-health-monitoring/
- Digital Mobile Sketch Mapping www.fs.fed.us/foresthealth/applied-sciences/mapping-reporting/digital-mobile-sketch-mapping.shtml

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- Forest Health Assessment & Applied Sciences Team www.fs.fed.us/foresthealth/publications/fhaast/index.shtml
- Forest Disturbance Monitor <https://data.nal.usda.gov/dataset/forest-disturbance-monitor>
- Department of Plant Sciences and Entomology <https://web.uri.edu/pse/>
- Division of Agriculture www.dem.ri.gov/programs/agriculture/
- Cooperative Agricultural Pest Survey www.dem.ri.gov/programs/agriculture/caps.php

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- Don't Move Firewood www.dontmovefirewood.org/
- Current Threats to Forest Health www.dem.ri.gov/programs/forestry/forest-health/forest-threats.php

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- Northeastern Forest Fire Protection Compact www.nffpc.org/en/

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- Forest Stewardship Program www.dem.ri.gov/programs/forestry/stewardship/index.php
- Farm, Forest, and Open Space Act www.dem.ri.gov/programs/agriculture/ffosa.php
- Natural Resources Conservation Service www.nrcs.usda.gov/wps/portal/nrcs/site/ri/home/
- Rhode Island Woodland Partnership <https://rhodeislandwoods.uri.edu/ri-woodland-partnership/>

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- Rhode Island Forest Conservators Organization www.rifco.org/
- Rhode Island Resource Conservation & Development Council www.rircd.org/
- Rhode Island Association of Conservation Districts www.riacd.org/
- RI DEM Division of Fish and Wildlife www.dem.ri.gov/programs/fish-wildlife/
- American Tree Farm System, Rhode Island Council www.treefarmsystem.org/rhode-island

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- State Parks www.riparks.com/
- Division of Agriculture www.dem.ri.gov/programs/agriculture/
- Health Equity Zones (HEZ) Initiative https://health.ri.gov/programs/detail.php?pgm_id=1108
- Emergency Management Agency www.riema.ri.gov/
- RI Regional Greenhouse Gas Initiative www.dem.ri.gov/programs/air/rggi.php
- Arbor Day Foundation www.arborday.org/programs/energy-saving-trees/
- Energy-Saving Trees <https://energysavingtrees.arborday.org/#Partners>
- Regional Greenhouse Gas Initiative www.energy.ri.gov/policies-programs/programs-incentives/rggi.php

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- RI Nursery and Landscape Association <https://rinla.org/>
- 13 municipalities www.arborday.org/programs/treecityusa/treecities.cfm?chosenstate=Rhode_Island
- one university www.arborday.org/programs/treecampususa/campuses.cfm
- §2-19-2 <http://webserver.rilin.state.ri.us/Statutes/TITLE2/2-19/INDEX.HTM>
- §2-14-2 <http://webserver.rilin.state.ri.us/Statutes/TITLE2/2-14/INDEX.HTM>
- resistograph <http://edis.ifas.ufl.edu/ep504>

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- Building Green Infrastructure in the US www.esri.com/en-us/industries/green-infrastructure/overview

- [Urban Forest Strike Team](#)

URLS for Referenced Links within the Forest Action Plan Pages 93 – 145 Appendices

Appendix A – p93 – 0 don't know # of pages yet

Appendix B p94

- 2015 Wildlife Action Plan www.dem.ri.gov/programs/fish-wildlife/wildlifehuntered/swap15.php

Appendix C p98

- Rhode Island's Farm, Forest and Open Space (FFOS) Program www.dem.ri.gov/programs/agriculture/ffosa.php
- RI Gen. Law § 44-27 <http://webserver.rilin.state.ri.us/Statutes/TITLE44/44-27/INDEX.HTM>

Appendix D p99

- The Value of Rhode Island Forests <http://dem.ri.gov/programs/forestry/forest-value.php>
- USFS Forest Inventory and Analysis www.fia.fs.fed.us/
- EVALIDator Version 1.8.0.00 <https://apps.fs.usda.gov/Evalidator/evalidator.jsp>
- Forests of Rhode Island, 2018 www.fs.fed.us/nrs/pubs/ru/ru_fs211.pdf

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Appendix F p129

- DEM Strategic Plan 2019-22 www.dem.ri.gov/director/documents/plan2018-22.pdf

Appendix G p134

Do we need the AON listed here as I suspect the references will be in report – but it will also change the page numbers

Appendix H p135